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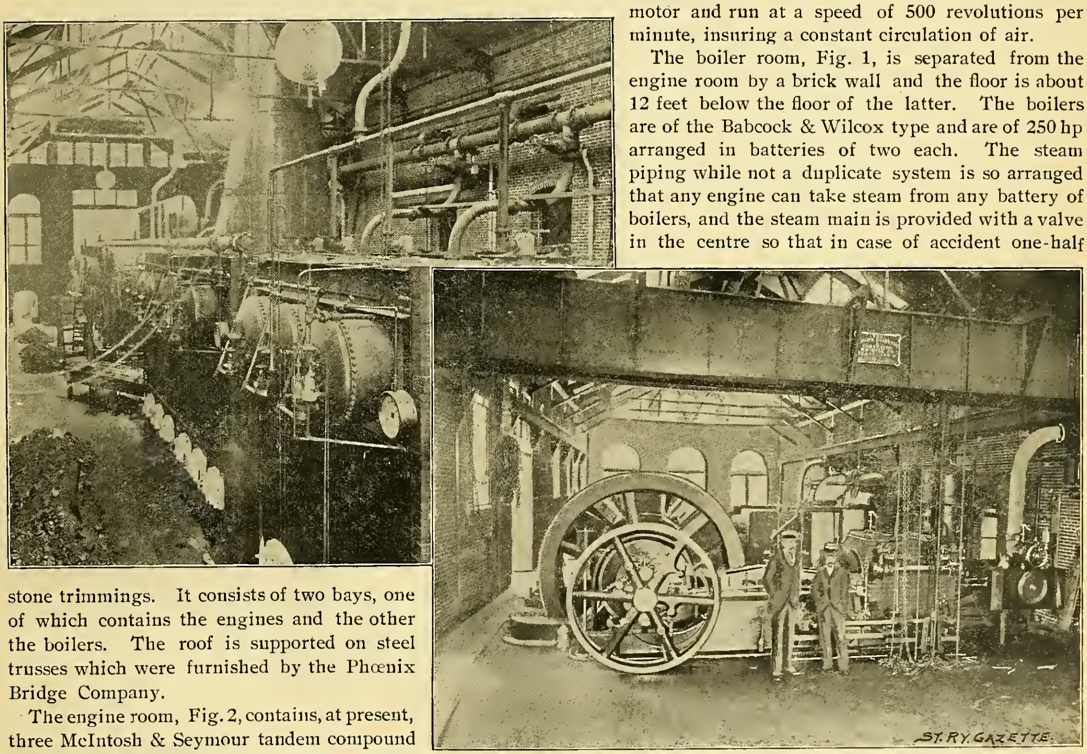
Vol. XIII. NEW YORK, JULY 6, 1895. No. 1.

New Plants of the Electric Traction Company of Philadelphia.—I.

The new power plant of the Electric Traction Company, on South Street, is rapidly nearing completion and it is expected that it will be in full operation in about a week.

The power house is located at Twenty-seventh and South streets on the line of the B. & O. Railway, and about 450 feet from the Schuylkill River. The site is an admirable one, as coal can be handled economically, and fuel and water for the boilers and condensers may be taken from the river. The building, Fig. 3, is a very substantial and attractive structure, and is constructed of brick with brown stone trimmings. It consists of two bays, one of which contains the engines and the other the boilers. The roof is supported on steel trusses which were furnished by the Phœnix Bridge Company.



FIGS 1 AND 2.—BOILER AND ENGINE ROOMS.

The engine room, Fig. 2, contains, at present, three McIntosh & Seymour tandem compound condensing engines of 600 hp each, with cylinder dimensions 16 and 32 inches and 24-inch stroke. They are run at a speed of 150 revolutions per minute and have fly wheels 10 feet 6 inches in diameter. One of the engines has been in operation for some time and since starting has given great satisfaction. The engineer in charge stated that it is remarkable in respect to easy running and reliability. The arrangement of the condensing apparatus is similar to that employed in the company's Delaware Avenue power station which was described in the GAZETTE of June 22. The condensers and air-pumps are located in the basement below the engine room, occupying a space about 20 by 30 feet. The floor above is left open so that the operation of the condensers may be seen from the engine room. The arrangement of the heaters and condensers is shown in the accompanying diagram, Fig. 4. The equipment consists of two Blake independent jet condensers and twin vertical air-pumps of the same make. The condensers, which have been in operation but a short time, have given excellent results, there being no difficulty in maintaining a vacuum of 28 inches in the general main, into which the engines exhaust. Excellent provision has been made for ventilating the engine room by the installation at each end of the building of two 36-inch Blackman fans, which are operated by an electric motor and run at a speed of 500 revolutions per minute, insuring a constant circulation of air.

The boiler room, Fig. 1, is separated from the engine room by a brick wall and the floor is about 12 feet below the floor of the latter. The boilers are of the Babcock & Wilcox type and are of 250 hp arranged in batteries of two each. The steam piping while not a duplicate system is so arranged that any engine can take steam from any battery of boilers, and the steam main is provided with a valve in the centre so that in case of accident one-half may be cut out, leaving half of the plant in operation. The plant is provided with two Berryman feed-water heaters of a capacity sufficient to take care of the entire plant.

One of the interesting features of the station is the Immendorf system for regulating the feed-water pumps. The apparatus works automatically; when the water reaches the proper level in the boilers the pumps are shut off, but are started again as soon as the water falls below the determined level. The feed pumps are of the Blake duplex type.

The Kellam damper regulator is employed with very satisfactory results, the steam pressure varying not over two pounds. The separators are of the Cochrane type made by the Harrison Safety Boiler Works, of Philadelphia, and Bristol recording steam and vacuum gauges are employed.

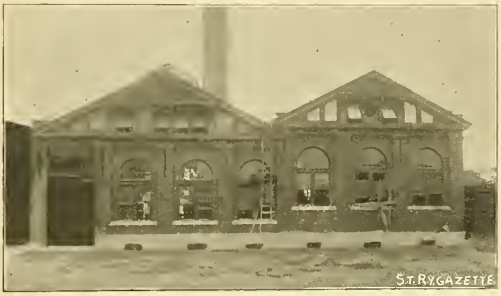


FIG. 3.—EXTERIOR OF POWER STATION.

The stack is of steel, lined with brick, and is 150 feet in height above the brick foundation, with a flue 8 feet 8 inches in diameter. The stack was built by the Tonkin Boiler Works, of Oswego, N. Y. The station was designed to burn bituminous coal, but anthracite may be used if it is found to be desirable. A spur track from the B. & O. Railway extends directly into the boiler room and eventually a complete system of coal-handling machinery will be installed so that fuel may be taken from boats at the wharf and delivered directly to the furnaces.

Proposed Subway for Chicago.

The Chicago Sub-Railway Company, which has asked for a franchise permitting it to build a tunnel in the central part of Chicago to connect the terminals of the several elevated railway companies, has issued a statement in which it is claimed that its schedules present the only solution of the rapid transit problem in Chicago. The opinion of the company's engineer, William Sooy Smith, are given somewhat at length. He opposes the construction of an elevated line in the central part of the city, as it will, the engineer says, fill the street from curb to curb, greatly obstructing traffic and keeping the light from buildings on both sides, necessitating artificial light. He also claims that the traffic of several lines on the loop will cause a noise and commotion so intolerable as to banish the retail business from all streets the elevated structure may occupy. The damage to abutting property, according to the engineer, will amount to more than the cost of the elevated line. He then refers to the immense sums already paid by the Manhattan Company, of New York, and the enormous claims still pending against that corporation.

Concerning the cost of the proposed subway, General Smith places the amount at $5,000,000, or $2,000,000 more than the elevated plan. He cannot conceive investors putting $3,000,000 into what he says would be a costly failure, when the most perfect rapid transit line in the world can be built for $5,000,000. A subway, on the contrary, he claims, would always be clean and well lighted with electricity, which would form the motive power, thus doing away with steam and smoke. General Smith announces that New York, after an exhaustive investigation of the best rapid transit roads in the world, and comparison of its own elevated system, has authorized the expenditure of $50,000,000 in subways, and this in the face of extraordinary difficulties in the construction of the latter, owing to the fact that the lower part of the city is wet and the upper part rock. He describes the subsoil of Chicago as an impervious clay, through which the water passes so slowly, if at all, that scarcely any trouble would take place in a well-built subway.

Japanese Electric Railway.

The Japanese *Electrical Friend* says that an electrical railway to cost $1,000,000 connecting Tokio and Yokohama, a distance of 18 miles, is projected.

Time Limit on Transfers.

An action has been begun in San Francisco by William Cunningham to determine whether a street railway company is warranted in limiting to a certain period the time on which a transfer ticket must be used. The defendant is the Market Street Railway Company. The plaintiff received a transfer ticket and admits that it was not used within the period prescribed by the company's rules. This limitation, he holds, is illegal. When he presented his transfer ticket to a conductor it was refused, and when the plaintiff refused to pay fare he was ejected from the car.

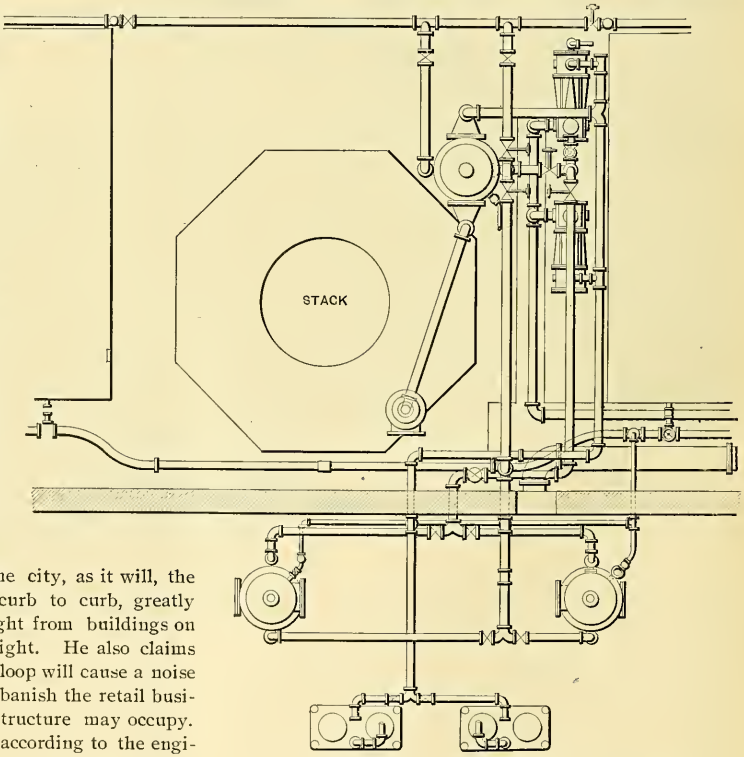


FIG. 4—ARRANGEMENT OF HEATERS AND CONDENSERS.

Accumulator Traction in Paris.

In the Street Railway Gazette of May 25 last, reference was made to the storage battery traction system of the Tramway Company of Paris and the Department of the Seine. The company has operated three lines by storage batteries since 1892. Faults were discovered in the original type of cars, and to avoid these a new model has been designed which is illustrated in Fig. 1. Its weight, when wholly equipped, is 11.7 tons, while that of the original type was 14 tons. Its imperial is extended at the rear, affording room for seats directly above the rear platform. The wheel base is 6 feet and 2 inches. The accumulators are not carried under the seats as in the former type, but in a compartment under the car between the axles as shown in the illustration. The receptacle which carries the cells is held by four steel supports attached to the truck. At the end of a trip when new batteries are required, a low wagonet is run under the car and carries away the receptacle, and a new one with charge cells is quickly substituted.

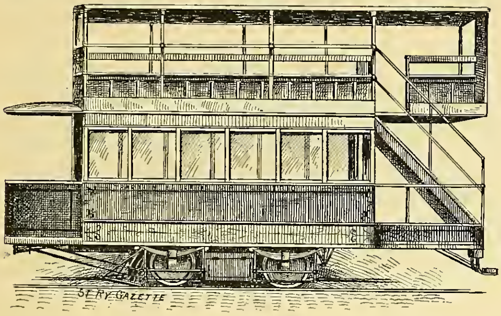
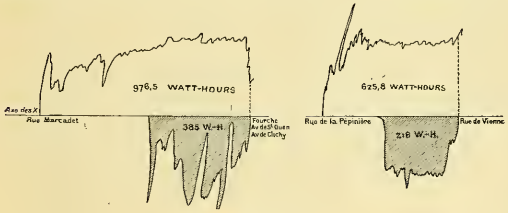


FIG. 1.

Each car is equipped with two single reduction shunt-wound motors, each of a capacity of 10 kilowatts. They make about 500 revolutions per minute, while the speed of those formerly in use was from 1,200 to 1,500 revolutions per minute. A very effective brake can be used by short-circuiting the armatures; in fact, tests have shown that the ordinary hand brake can be dispensed with, but the latter has been utilized in order to comply with municipal regulations. The cars are provided with sand boxes.

As the motors with which the car is equipped are shunt-wound they may be used as dynamos on the down grades to generate current to add to the charge of the batteries. The recovery gained in this way amounts, it is said, to 18 per cent. of the total amount used for operating the cars. Figs. 2 and 3 are wattmeter curves, the former for the operation of a car in Avenue de Saint Ouen and the latter for the operation of a car in the Rue de Rome. Fig. 2 shows that in this part of the line 976.5 watt-hours were consumed in operating the car and that 385 watt-hours represented by the shaded portion were recovered on the grades. In Fig. 3, 625.8 watt-hours were consumed in operating the car and 216 watt-hours were recovered on the grades.



FIGS. 2 AND 3.

The following figures were obtained at a test of the car during the present year:

Distance traveled from station at St. Denis to the Madeleine and return, about 11.9 miles.
Height of car (battery charged), 12 tons.
Time going, 56 minutes.
Time returning, 44.51 minutes.
Discharge, outgoing trip, 44.51 ampere-hours.
Recovery, outgoing trip, 7.77 ampere-hours.
Discharge, return trip, 43.13 ampere-hours.
Recovery, return trip, 9.05 ampere-hours.
Total discharge, 87.64 ampere-hours.
Total recovery, 16.82 ampere-hours.
Net discharge, 70.82 ampere-hours.
Residue in battery, 25 ampere hours.
Discharge, per ton per kilometre, without recovery, .383 ampere-hour.
Discharge, per ton per kilometre, with recovery, .309 ampere hour.
Average difference of potential, 105 volts.

Some Practical Notes for Motormen.—VI.

BY GEORGE T. HANCHETT.

As bipolar, that is, two-pole motors, are the simplest, they will be considered first.

Fig. 17 shows what is called a Gramme-ring winding, swinging in a bipolar field. The ring winding is the simplest of windings. A ring built up of laminated or subdivided iron is suspended on a spider on the shaft. This ring is overwound with wire as in Fig. 17, and at various equal materials branch wires are soldered on to the winding and brought down to the commutator bars. The mechanical construction is very simple. Let us see how the current enters the armature and keeps the longitudinal conductors in front of the north pole, supplied with current in one direction, while the conductors in front of the south pole are supplied with current in the reverse directions, for this we have seen by our experiments is necessary.

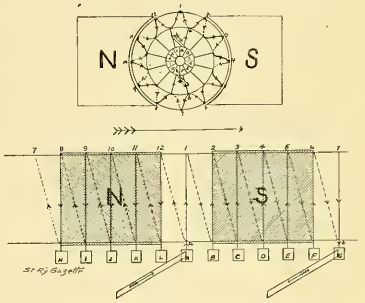


FIG. 17.

Bearing on the surface of the armature are two brushes, one of which feeds current to the armature, and the other permits it to leave and return to the generator at the station. The arrows show the direction of the currents.

The current starts in at the upper brush and flows into the commutator segment directly under it. From thence it flows into the wire leading to the winding. At *a* the current divides precisely as would a current flowing in a pipe at a tee joint. One half of the current flows down the spiral turns on one side of the armature, and the other half flows down the other side. Now carefully note that *all wires on the surface of the armature in front of the north pole have the current flowing toward the front of the armature, while those in front of the south pole have the current flowing toward* *the rear of the armature.* These wires, as our experiment has told us, will produce motion in one direction.

As the winding is perfectly symmetrical, that is, one part of the winding is the same as any other, it follows that no matter how much the armature may revolve, the wires in front of the north pole will always carry current to the front, and the wires in front of the south pole will always carry current to the rear. Thus the poles and wires always mutually interact to produce rotation as long as there is magnetism in the one and current in the other.

In the developed armature surface, the relation of pole and direction of current is still the same. In front of the north pole is a band of wires carrying currents *down*, while in front of the south pole is a band of wires carrying currents *up*.

Complicated windings with many poles may be simply verified by tracing out the currents as they flow in the wires, and making sure, first, that in front of any one pole the current flows in the same direction in each wire; second, that the direction of flow is the reverse in front of a south pole from what it is in front of a north pole, and third, that this condition of things is always maintained, however much the armature may turn. These things are necessary for the operation of the armature, and are accomplished in every winding. The relative merit of different methods of winding depends upon numerous other things, viz.:

First. The amount of dead wire, or wire used in connecting the driving conductors to each other and to the commutator.

Second. The uniformity of resistance of separate coils. Well made armatures have the resistance of every coil connected between two adjacent commutators just the same.

Third. Ease of repair, that is, winding in such a way that the removal of one or more coils for repair will not necessitate the removal of other coils.

Fourth. Cheapness of manufacture.

Different methods of winding are also used according to the service for which the motor is intended. For high-voltage motors, it is well to have more coils in series than in low voltage.

(To be continued.)

Proposed Conduit Railway at Leeds, England.

The City Council of Leeds, England, has been considering the advisability of installing a conduit system in place of the existing overhead trolley system in the central part of the city. The city engineer has recently presented a report on the question. The length of single conduit which it is proposed to install is 2.77 miles. The engineer computes that the total additional capital required for the substitution would be £10,183, and taking all the pros and cons into account, he thinks that a penny, or a little over, per car mile would represent the excess of cost of running the conduit system over the electric overhead system. He therefore puts the total approximate extra annual cost of electric conduit over electric overhead for the central portions of the track at £2,230. The difficulties and objections to the electric conduit system are, he says, an occasional stoppage of the cars through short-circuiting, brought about by adventitious matter finding its way into the conduit; a wide slot, dangerous to narrow wheels, unless an improvement on the Buda-Pesth system is made; frequent obstruction of the traffic of the most crowded streets of the city by taking them up for the repair of the electrical portion of the conduit.

New Railway Motor.

A new single reduction series motor of 50-hp (known as No. 38) has just been brought out by the Westinghouse Electric & Manufacturing Company to meet the requirements of greater speed or heavier work. It is the same motor that is being used by the Pennsylvania Railway at Mount Holly, N. J., in its experiments with high-speed electric cars. In design the motor is very similar to the well-known type 12A, though slightly larger and heavier. The novel features are the use of a cast-steel yoke with laminated pole-pieces and a ventilated armature. This form of construction is the same as that which has been used for a long time by the Westinghouse Company in its railway and alternating-current generators, where these excellent qualities have contributed to an exceedingly high efficiency. The motor is entirely encased, and thus made water and dust-proof. It is intended to be used with any one of three sets of gears having a ratio of 1 to 4.86, 1 to 3.44 and 1 to 2.3, and intended respectively for slow-speed freight and snow sweeper work, city passenger traffic or suburban high-speed service. The very symmetrical and simple form of ventilated armature winding is clearly shown in Fig. 1. The use of air passages parallel to the shaft, in the core, results in an efficient and at the same time very cool running armature. The motor is designed to be suspended as shown in Fig. 2, by a single spring under the "nose" or lug projecting from the circular yoke, or, as the Westinghouse people prefer, by bars which pass through supports on each side of the motor and have their ends supported on springs. The general methods of design and some improvements in minor details have made it possible to construct a motor of great power and efficiency, and at the same time the dimensions are such as to readily adapt the motor to the limited space available under ordinary forms of street car.

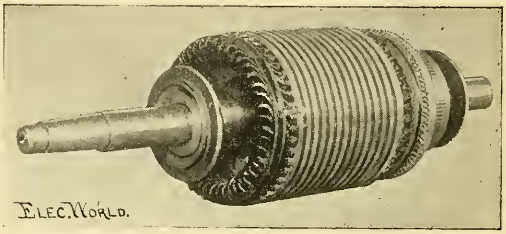


FIG. 1.

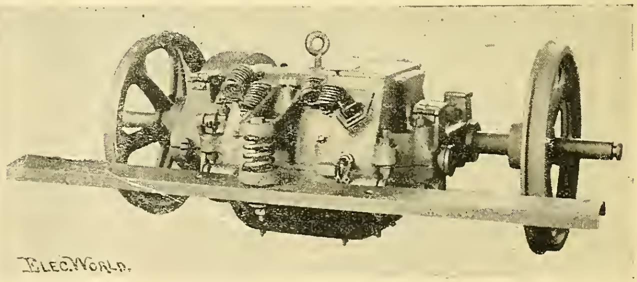


FIG. 2.

The Substitution of Electricity for Steam in Railway Practice.*

BY DR. LOUIS DUNCAN.

In an address delivered before this Institute in June, 1892, Mr. Frank J. Sprague spoke of the coming development of electricity as applied to railways, and outlined his views as to the direction of this development. In the last three years great extensions have been made in electrical transportation, and it seems well to review briefly the amount of these extensions and their direction. In this paper I shall consider electric traction as it stands at present, not the possibilities of the future.

In the last seven years electricity has largely taken the place of horses for tramway work, and it is now beginning to replace cables, although the latter have been recently installed at great expense. At first the lines were confined to the limits of towns and cities, but they have been extended first into the suburbs, and then to the neighboring towns, and the extensions have brought them in competition with the steam roads. The reports of the earnings of the railway companies in the United States show that after paying fixed charges only a small amount of the net profit remains to be applied to dividends on the stock. Any general decrease in the earnings, even if it is only a small percentage of the total amount, will wipe out the narrow margin that is now applied to dividends, and the absorption by the electric lines of the local travel formerly conducted by the steam lines promises to do this. At first the managers of the larger steam roads ignored the growth of their electrical rivals, but the time has come when they can no longer ignore the decrease in the receipts from their local passenger travel, and they are beginning to face the difficulty and to carefully study the situation.

In this paper I will briefly take up the following questions:

1st. Given a railway system at present operated by steam; will it pay to change entirely to electricity, or to make a partial substitution, and how should the change be made?

2d. If entirely new lines are to be built, is it likely that it will pay to equip them electrically? How should they be equipped?

3d. I will describe the equipment of the B. & O. tunnel plant and draw from it what morals I can.

In order that it should pay a railway to make a change in its motive power, the effect of the change must be either to increase the receipts or decrease the expenses, by an amount equal to the interest on the cost of the change. There should theoretically be such a gain; practically, the amount would be greater in order to justify the change, to take into account those elements not capable of exact calculation, and also the fact that an increase in the fixed charges of a road is a more serious matter than the mere amount of it, for although the average for a number of years might show a gain by the substitution of electricity, in a bad year the increased fixed charge might cause difficulty.

There are two very distinct sides to the question of transportation, the passenger side and the freight side, and their requirements for good service are very different. First taking up the question of passenger travel, the receipts of a road are increased by running trains at short intervals and at high speeds, and this is a condition peculiarly favorable to electricity. On an electric line short trains equally distributed over the track, give a greater station efficiency, and the lowest cost of equipment of both station and line. The cost of train service is somewhat greater, but is compensated by the saving in the other items.

The cost of hauling a given number of passengers between given points by steam is greatly increased when the number of trains is increased, the efficiency is less, and the cost of equipment of train service is greater. Wellington states that doubling the number of engines for a given traffic increases the cost of transportation about 50 per cent.

On the other hand, if you take up the question of freight traffic, the conditions of greatest economy are reached when trains of a maximum weight are hauled by a single locomotive. The tendency in late years has been in the direction of increasing the size of the locomotive, the capacity of the cars and the length of the trains. These changes have necessitated more solid and expensive roadbeds, heavier rails, and general strengthening of bridges. The outlay has been enormous, but the decreased cost per ton mile for freight transportation has shown the wisdom of the change. On one of the larger roads, which publishes careful yearly statistics, I find that the cost of transportation per ton mile in 1870 was 1.15 cent, and in 1895, .56 cent, on another road it was 1.9 cent in 1864 and .447 in 1893. Number of tons per train mile on the first road in 1870 was 103, while in 1890 it was 226. In attempting to carry on traffic of this kind by electrical locomotives operated from a central station, we find that we are at a great disadvantage because of the irregular service necessitated by the freight traffic and the unequal distribution of the load along the line. Suppose, for instance, that there were two stations supplying the lines and that the traffic was uniformly distributed along it, then the capacity of each station would be one-half of the total required capacity. Suppose, however, that the entire traffic was concentrated in one train, then each station would have to have a capacity equal to the total power required for hauling the entire traffic, as the train would be first supplied from one station and then from the other. The line also would have to have a capacity suitable for handling the total traffic. If a number of heavy trains were used, and the traffic was irregular and liable to be congested at one point, as in the case of freight service, then again the capacity of the station would have to be greater than that required to supply one-half of the normal traffic. If we were to decide to transmit the current to a longer distance, and to supply all the track from one station, using transformer devices along the line, then the capacity of the station itself would only be that required for the normal traffic of the line, but the transformer devices would have to be sufficient to handle the maximum traffic of the section which they supplied, and would have to be given a capacity greatly in excess of the average load in order to supply this energy. We must distinctly bear in mind in considering the application of electricity to steam roads any departure from a uniform distribution of load along the line will increase both the cost of equipment and the cost of operation.

In looking over the reports of the same road from which I have given freight statistics, I find that in 1870 the receipts per passenger mile were 2.09 cents, while the expenses were .59 cent. In 1890 the receipts were 1.9 cent, while the expenses were 1.47 cent. During this period passengers per train mile have decreased from 79 to 59. Comparing these figures with those given for freight transportation, we find that the two types of traffic have gone in opposite directions in the period which we have been considering. The amount of freight transported per train mile has more than doubled, and the expense has decreased more than one-half. The passengers per train mile, on the other hand, have decreased, and the expenses have changed only a slight amount, notwithstanding the greater economies that have been put in force in the interval. Passenger traffic has come in the direction in which electricity is the most economical for transportation; freight traffic, on the other hand, has gone in the direction where electricity becomes most costly. It might be argued that some new scheme for freight transportation by electricity might be used, but it would be difficult to devise any system more economical than that at present in use, and the great amount of through traffic on freight lines precludes the possibility of devising any system which differs radically from that at present in use. For instance, taking the figures from the records of the Pennsylvania Railway for 1893, I find that the freight mileage of foreign cars on the Pennsylvania road east of Pittsburg in round numbers $370,000,000, while the freight mileage of home cars is $436,000,000, making almost 46 per cent. of the total mileage made by foreign cars. It would seem then impossible to change the present system of freight traffic without disorganizing the service and decreasing the freight revenue of the road. The importance of freight traffic is shown by the fact that the earnings from freight on all the roads in the United States is between two and one-half and three times as great as that for passenger traffic. The New York Central Railway Company in 1892 received from their freight traffic $26,000,000, and from their passenger traffic $13,000,000. On the lines of the Pennsylvania Railway east of Pittsburg, the freight receipts were $47,000,000, as against $17,000,000 for passenger receipts.

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* Inaugural Address delivered at the Niagara Falls meeting of the American Institute of Electrical Engineers, June 25, 1895.

Suppose, then, the question comes up before the managers of a road as to whether they are to equip their lines to be operated entirely by electricity. It seems to me, as matters now stand, it will not pay trunk lines to change the method of operation for freight traffic, and the question to be considered would be the operating of the lines partly by steam and partly by electricity. Let us consider if it is possible to run the passenger service wholly or partly by electricity. Considering a two-track road doing a through as well as a local business, I think we can decide that unless the case be an exceptional one, it will not pay to equip the main line electrically. It is necessary that the through express service be continued, and that the freight service be continued, and an attempt to operate the local trains with the through trains could not be successful if there was any considerable amount of through traffic. With a four-track road the condition of affairs is somewhat different. If the road operates between cities acting as terminal points for all passenger traffic, as with some of the lines between Boston and New York, then by equipping all four tracks it would be possible to run express service at short intervals on two of the tracks, and on the other two tracks to run freight and local trains. At present it would not pay to use electric locomotives operated from a central station for the freight service, but the local service could be operated electrically, and as the speed of the local trains would be approximately equal to that of the freight, there need be no serious interference with the traffic. We would then have express passenger service working under favorable conditions, that is, with a number of trains evenly distributed; a local service operated under similar favorable conditions and with no interruption to the freight traffic. If the road, however, is to transport a considerable number of foreign cars, as, for example, the New York Central or the Pennsylvania Railway, then the condition of affairs for express service would not be so favorable, and the question of the equipment of the tracks for express service would have to be carefully considered. As far as the branch lines go, whether it would pay to partially or wholly substitute electricity for steam, depends upon the local conditions. A long branch with a small amount of local traffic would not pay to equip, but on a short branch with considerable passenger traffic and comparatively little freight traffic such equipment would pay. I find that in 1892 the total number of through passengers carried by the New York Central road was 234,650, while the number of local passengers was 21,978,979. It will be seen that the through traffic is but a small percentage of the total number of passengers, and that the question of preserving the local traffic is of great importance. Now the greater part of this local traffic will, in the next few years, be taken by the electric roads paralleling the steam roads unless some effort is made either to control the electric roads or to give an equally good service between adjacent towns. This latter is possible, using the ordinary steam tracks only when the distances between towns are small and the amount of freight or through traffic is also small.

There are certain kinds of local traffic which the steam roads must, to a large extent, lose, and which, in the nature of things, they cannot regain. In large cities having a considerable suburban traffic the trolley roads, forming as they do a network of lines within the city, and extending in every direction into the suburbs, offer advantages with which the steam roads cannot compete. In Philadelphia one of the large steam lines lost so much traffic that it has attempted to regain it by reducing prices and increasing the number of trains. In this effort it has partly succeeded, but at the cost of greater expense and decreased receipts. To counterbalance this loss at central points railways may hope, by the introduction of electricity, to increase their earnings along the lines and on their branches.

As to the nature of the equipment that will be required, it would depend on the work to be done and the branch that is to be equipped, in some cases it might be well to use single electric cars running on the steam tracks between towns and on the local tram lines in the towns. As the speed would be very different in the town and on the railway line, and as the voltage could also be different, it would be well in this case to use a number of motors on the car, and to use a series parallel controller, the motors being in series for the town traffic. For instance, suppose we wish to run at a maximum speed of 40 miles per hour between the two towns, and it is economical to use 1,000 volts on the line, we could use two motors on the car, run them in parallel on the main line at a speed of 40 miles per hour, while in town, with a voltage of 500, we could run them in series at a speed of 10 miles per hour. I can hardly imagine a case where the three-wire system could be economically used for such service on the steam lines.

(To be continued.)

Fender Suits.

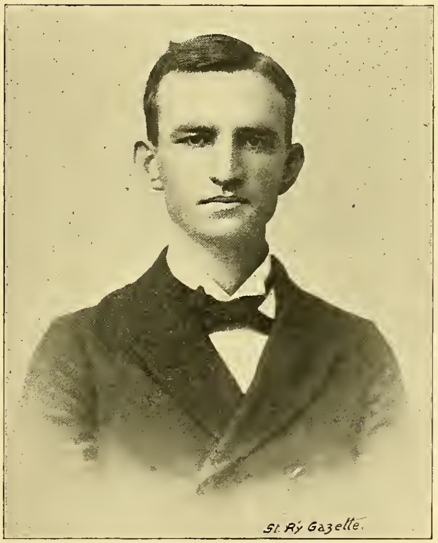
Suits have been begun in Brooklyn against three street railway companies of that city to recover penalties for their failure to equip cars with fenders in accordance with the provisions of the city ordinance.

Street Railway Engineers.—X.

N. W. L. BROWN.

Mr. N. W. L. Brown, who holds the position of roadmaster of the Atlanta Consolidated Street Railway Company, has had a somewhat extended engineering experience. He was born in Hurtsboro, Russell County, Ala., and his early education was gained in the village academy of that place. In 1885 he was engaged as rodman in the re-survey of the Mobile & Girard Railway, and in the fall of the same year he acted as transitman in the surveys for an extension of the Columbus (Ga.) & Rome Railway. In the spring and summer of 1886, he was employed in the surveys of the Columbus (Ga.) & Western Railway, and in the fall of the same year served in a similar capacity for the Kansas City, Memphis & Birmingham Railway. Subsequently he acted as assistant engineer on construction for the Columbus & Western Railway, and in the spring and summer of 1887 he held the same position with the Kansas City, Memphis & Birmingham Railway, being engaged on heavy grading work, serving as lumber inspector and pile inspector, and running centres for the track-laying gangs.

In the fall of the same year he took charge, as resident engineer of the same company, of the grading for the depot grounds and siding extensions in Jasper, Ala., the work being wholly in solid rock. In the following winter he laid out three towns for the same company, and was then put in charge of the final compilation of the accurate notes of the railway. While in charge of the party engaged in this work he started at Memphis, in January, 1888, and after several interruptions finished by the following June the measurement by steel tape of the profile and completed the topographical notes of the 253 miles of road which extended to Birmingham. Subsequently he acted as assistant of the chief engineer, and resigned in August, 1888, to enter the civil engineering course in the Rensselaer Polytechnic Institute of Troy, N.Y., from which institution he was graduated in 1892. During the next year Mr. Brown was engaged in the factories of the General Electric Company, at Lynn; was employed by the Sperry Electric Railway Company at Chicago, Cleveland and Youngstown, O., and then entered the students' department of the Westinghouse Company at Pittsburg, Pa. In the spring of 1893 he assumed charge of the track and line repair and construction work of the Atlanta Consolidated Street Railway Company and has since been in the service of that company. During this time he has built over 20 miles of track for the company. At the last convention of the American Street Railway Association Mr. Brown, it will be remembered, was in charge of the exhibition of street railway apparatus. He is a member of the Sigma Chi fraternity and a junior member of the American Society of Civil Engineers.


St. Ry Gazette.

N. W. L. BROWN.

Electrolytic Corrosion.

George W. Plympton and Fred R. Lee, the subway commissioners of Brooklyn, have recently sent a communication to Mayor Schieren, of Brooklyn, calling his attention to the electrolysis of underground pipes by escaping street railway currents. They say: "The situation is briefly this: Serious injury is being done to the water mains belonging to the city by the electric current escaping from the rails of the trolley roads. A carefully conducted survey made under the direction of this board indicated the affected areas, and suggested a means of preventing, for the time, at least, the destruction. The method proposed by the expert who made the survey was applied along one line of trolley road for a limited distance. It involved the attachment of a conductor at frequent intervals to the water main. The method proved effective. A re-survey of the region selected for the experiment proved that where corrosion was surely in progress in November last, there is none now. The proposal of the trolley company to apply the same remedy in other places is met by the refusal of the commissioner of city works to grant the necessary permits. With this refusal, the citizens cannot justly find fault. The commissioner is informed by his legal advisers that to give his official sanction to the proposed plan of connecting electric wires to the water pipes, would imperil the claim of the city for damages upon the trolley companies, if in the future the method adopted should cease to be effective, and the destruction of the pipes be found again in progress.

"Now, it cannot be affirmed that the remedy once applied is good for all time, and the commissioner of city works in refusing to sanction the method as a permanent cure for the difficulty is quite properly careful of the city's interests. The trolley companies must now rely upon one of several other methods for the return of their currents to the power stations. These are: First, welding the rails at every joint; second, employing a heavier copper band at the rail joints; third, making frequent connections between the rails and a return conductor of suitable dimensions, and which may be either buried in the ground or preferably carried on the pole lines back to the station. Only one road, the Nassau, has adopted the first of the above methods. The other roads have applied the second and third methods with various degrees of success, but in many places the current escapes from the rails and is conducted by the water and gas pipes. The localities in which such condition prevails are shown in the map accompanying the last annual report of this board. The districts therein indicated as liable to suffer from electrolytic corrosion should be frequently examined and all faults in the joining of rails and conductors speedily corrected."

ELECTRIC RAILWAY GAZETTE

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As THE ONLY PUBLICATION in the world DEVOTED TO THE ELECTRIC RAILWAY INDUSTRY, and the only journal adequately treating THE NUMEROUS TECHNICAL FEATURES INVOLVED IN ITS MODERN DEVELOPMENT AND PRACTICE, the ELECTRIC RAILWAY GAZETTE aims worthily to represent the activity and progressiveness of the important interests to which it is devoted. Presenting ALL THE NEWS EVERY WEEK, and describing CURRENT IMPROVEMENTS AND DEVELOPMENTS immediately upon being brought forward, its pages offer to those engaged in the electric railway field the TIMELY ADVANTAGES ENJOYED IN OTHER ACTIVE AND IMPORTANT BRANCHES OF MODERN INDUSTRY, and to advertisers A LIVE AND ENERGETIC MEDIUM commensurate with their needs and one giving CLOSEST ACCESS TO THE COMMERCIAL OPPORTUNITIES OF AN EXTENSIVE AND GROWING BUSINESS.

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ELECTRIC RAILWAY GAZETTE.

As with this issue a new name takes the place of the old, familiar title of this journal, it may not be amiss to explain briefly the reasons which have influenced us in making the change. For years STREET RAILWAY GAZETTE was properly regarded as a sufficiently comprehensive designation indicative of the scope of the paper, but the field to the interests of which the publication is devoted has of late changed and broadened to such an extent that the old name has become less and less accurate and explicit. The explanation is obvious. That the development in the field of traction has been wholly in the direction of electricity it needs no argument to prove. As a natural result the GAZETTE, as a representative, progressive journal, has become almost exclusively an electric railway paper, and it is fitting that its name should indicate the fact. But still another reason has seemed to point to the propriety of the change. Electric traction development did not stop with the equipment of purely local lines; it has been rapidly extending to suburban and interurban roads which cannot be properly classed as street railways. It has seemed proper, indeed imperative, that the progress in this widening department should be chronicled in our columns, if the interests of the reader were to be consulted, and we have steadily pursued the broader policy, despite the fact that we were constantly passing the limits of the somewhat circumscribed street railway field. With its new title the paper will be able to follow a more consistent course and will not appear to be continually reaching out to new lines of activity lying beyond the proper sphere of its usefulness. No other significance attaches to the change; the new name is adopted solely because it more closely fits the facts. The ELECTRIC RAILWAY GAZETTE will continue to represent the progressive traction interests with vigor and enthusiasm. The only weekly in the field, it will present the news when it is fresh, and discuss topics when they are timely.

NANTASKET BEACH ELECTRIC LINE.

If any doubt has remained in the minds of steam railway men of the practicability and desirability of utilizing electricity for the operation of branch lines it cannot be cherished longer. The success which has attended the Nantasket Beach Railway installation is unmistakable. We have it upon reliable authority that a speed of 50 miles an hour has been attained which is certainly considerably in excess of that likely to be required in the ordinary operation of the line. No one familiar with the working of the overhead trolley system as applied on the best street railway lines will experience any surprise in reading the results of the tests of the Nantasket Beach road, but we fancy that the facts will come as a revelation to a considerable number of conservative steam railway men who have been inclined to regard the trolley system as worthy of little consideration so far as their purposes are concerned. What is apt to attract the attention and interest of the manager to a still greater degree is the fact that a substantial economy is likely to be effected in the working of the road. The Nantasket Beach line will not long be the only steam branch line electrically equipped. It will be duplicated in the next year or two in a vast number of places. Its creation is a proof of the fact that steam railway companies are realizing that the wise plan to follow to fight the competition of the trolley lines is to meet them on their own ground and use the same weapons.

SUBSTITUTION OF ELECTRICITY FOR STEAM.

The address of Dr. Louis Duncan, at the Niagara Falls meeting of the American Institute of Electrical Engineers, was devoted to a timely discussion of the practicability of substituting electricity for steam in railway practice. At the present time we fancy there is scarcely a steam railway manager in the country whose serious attention is not directed toward the problem. The time has long passed when the competition of electric railways could be sneered at. The local lines have been cutting off the profitable short-haul traffic of the great systems until the owners of the latter have waked up to the necessity of taking measures to protect their business. Some of the companies have sought to curb the activity of the electric lines by legislative enactments, but at the same time they have realized that modern improvements cannot be more than temporarily checked and that some better policy must be pursued to save their dividends. They are commencing to ask: Is it advisable in the light of present knowledge to substitute electricity for steam? Dr. Duncan answers the question in his address, and his reply, we believe, will prove eminently useful and satisfactory to those who are in search of information. The question is considered from the view-point, not of the electrical enthusiast who sees visions and dreams dreams, but from that of the practical engineer who is called upon to install plants for money makers. He believes that the time has not yet come when the great steam railway companies should make a complete adoption of a new motive power, but at the same time he has no doubt that eventually all the traffic will be done by electricity and it is imperative that the managers of steam roads should keep in close touch with electrical progress. It is to their interest to make electricity their ally and not their enemy; in fact their only safety lies in such a policy. Prudence, however, dictates that the steam railway companies while not adopting electricity for the operation of their entire systems should not delay entering the electrical field in a limited way, according to Dr. Duncan. He believes that it would not be profitable at this time to use electric locomotives operated from a central station for freight service, but argues that the local service could be worked electrically. The favorable conditions which would follow such an arrangement are pointed out by the author at length. The conclusions which are drawn from an exhaustive consideration of the subject, are these: It will not pay any through line with considerable traffic, having two tracks, to equip its main tracks electrically. With four-track roads it will pay to equip all of the tracks electrically unless a considerable portion of the business is through passenger traffic. It will pay all the larger roads either to equip a number of their branch lines electrically, or to control competing electric lines. In order to remain on a dividend-paying basis it is imperative that most of the two-track lines either build additional tracks or control the electric roads that parallel them. The premises from which these conclusions are drawn seem to us sound and well taken. The address is conservative, too conservative it may be thought in some quarters, but is all the more worthy of attention on that account.

What Is a Fender?

Since the fender ordinance has gone into effect in Philadelphia it appears that there is no general agreement in regard to the definition of a fender. The director of public safety holds that the appliances with which some of the local cars are equipped are not fenders within the meaning of the law. In order that the possibility of doubt on this subject may be removed an ordinance defining a fender has been introduced in the Common Council, but it cannot become a law in any event until next fall, as the next meeting of the Council will not be held until Sept. 5.

The ordinance provides "that on and after 20 days from passage every trolley car in the city of Philadelphia shall have a front fender and wheel guard. The front fender shall be constructed so as to ride at the distance of six inches from the track, extending not less than three and one-half feet in front of the bumper, and high enough to prevent contact of any person with the dasher and drawbars of the car, and made of such material and in such manner by springs, rubber, ropes or levers as to yield and break the force of the blow of said car against any person who may come in contact therewith.

"Both sides of the said front fender and said car shall be protected by a side screen or guard not more than six inches from the track and extending back from the foremost part of said fender as far as the truck of the front wheels.

"Immediately in front of the wheels there shall be a wheel guard set to ride not more than three inches above the track. Said wheel guard shall be provided with springs sufficiently powerful to force it hard down on the track and to prevent a child's body from passing under it to the wheels.

"In front of said wheel guard there shall be a light lever not more than three inches from the track and connected with the springs of the wheel guard in such manner that the body of a child cannot pass under said lever without the automatic release of said springs and the forcing down of said wheel guard on the track."

American Institute of Electrical Engineers.

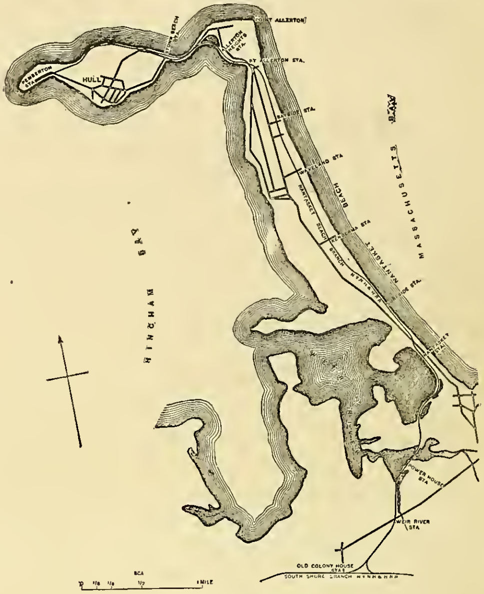
The general meeting of the American Institute of Electrical Engineers was held last week at Niagara Falls. The meeting was successful in every respect. The attendance was large, numbering over 200, and the papers covered a variety of interesting subjects. The inaugural address of the president was devoted to the timely subject of the "Substitution of Electricity for Steam in Railway Practice." An installment of the address, which is of an exhaustive character, appears elsewhere in this issue.

Nantasket Beach Electric Railway.

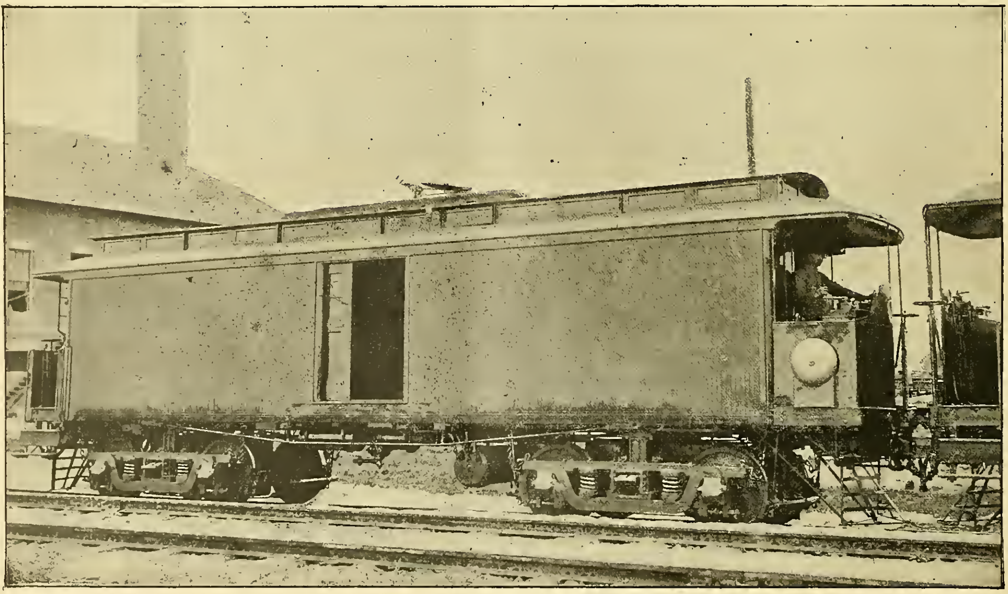
The first application of electricity on the Nantasket Beach branch of the New York, New Haven & Hartford Railway has proved remarkably successful. The line was almost exclusively operated by the electric trains on the 30th of June. The railway extends from the Old Colony House station as far as the Pemberton station, a little beyond Hull, at the extremity of the narrow peninsula, one side of which is known as Nantasket Beach. The length of the road is 6.91 miles, of which 20 curves comprise 4.4 miles, the sharpest curve being one of 10 degrees. The line is almost level, the only grade, one of about 34 feet to the mile, occurring within the first mile out from the Old Colony House station, the name of which has been recently changed to Nantasket Beach Junction. The track is laid in 70-pound rails, with 15 feet space between the track centres, and the ballast is of stone. Each point is bonded with a flexible No. 0000 bond of stranded copper, seven inches long, riveted into the flange of the rail. The line traverses two trestles and one plate girder bridge, the latter located near the Stony Beach station. Engineering difficulties were, of course, met with. Six thousand yards of rock ledge were taken out near the Old Colony House station, and between Stony Beach and the terminal station at Pemberton a heavy retaining stone wall was built on the shore side of the track. The height of the wall ranges from six to 21 feet and contains 6,000 cubic yards of masonry.

On the sea side of the track, a second retaining stone wall, about three quarters of a mile long and varying in height from eight to 15 feet, and in thickness from 10 to 15 feet, has been constructed to take the place of a trestle. There are at present 10 stations on the line, but other stations will be built to allow of stops at about every quarter of a mile. At Pemberton, the station consists of two 500-feet roofed platforms between the tracks, and a similar length of platform outside the tracks.

The overhead trolley line is carried upon poles which are placed between the tracks, and are of southern pine, 30 feet long, 12 inches by 14 inches at the butt, and 10 inches by 10 inches at the head. They are set at intervals of 60 and 70 feet on the curves and 90 feet on the straight track. At the cross-overs the posts are 180 feet apart, and side posts are used for carrying a light iron truss over the track. On the trestles they are carried down through the trestle floors and are bolted to cross timbers fastened to the piles. The top of each pole is fitted with a cast-iron grooved cap, the grooves of which carry the six bare copper feeder cables, each having a cross-section of 500,000 circular mils and weighing 1.56 pounds to the foot; each consists of 49 No. 10 gauge



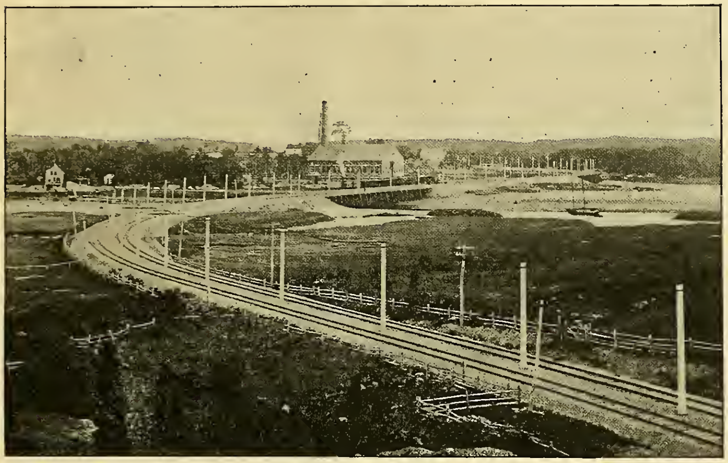
MAP OF ROUTE.



BAGGAGE AND MOTOR CAR.

wires being laid in seven wires of seven strands each. The poles are set in wooden boxes filled with concrete, and are set toward the inside track on curves to throw the trolley wire over, and thus provide for the angle of the trolley pole caused by the 4.8 inch elevation of the outer rail.

The trolley wire is of unusual shape in cross-section. It weighs one pound per foot and has a cross-sectional area of 330,000 circular mils. The lower surface is almost flat, and provides a large contact surface for the trolley wheel. This form has been given to the wire to permit of a more perfect attachment to the hangers and to prevent the trolley from jumping when passing them.



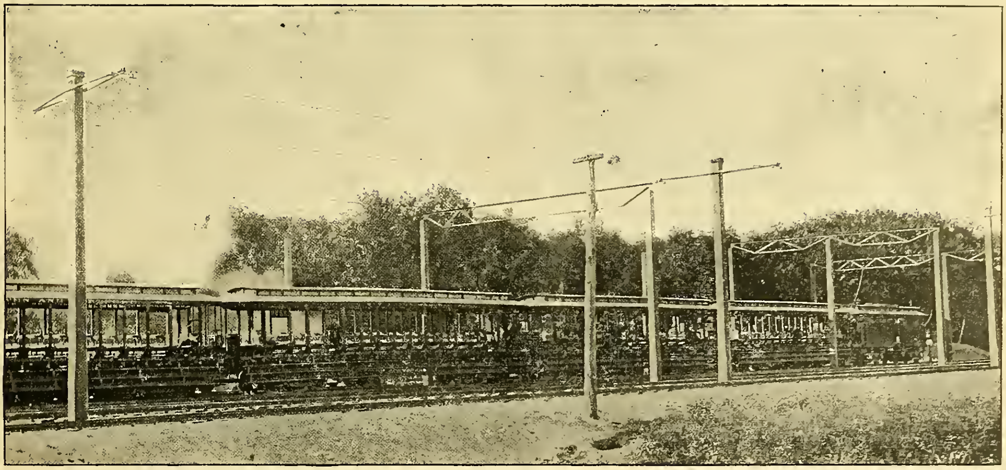
ONE OF THE CURVES.

The brackets, of two angle irons, are bolted across the centre poles and bent and bolted together at the ends. They are kept in position by an iron truss running through the cap. Each hanger is double and gives an excellent support for the wire. In stringing the trolley wires and setting the poles, steam locomotives were employed, and by their use the work of months was shortened into weeks. Indeed, the entire installation is an example of extremely rapid work.

The power house, known as Power Station No. 1, of the New York, New Haven & Hartford Railway, is located 5,900 feet from the junction station. It is a brick station with stone trimmings erected on a rock foundation, and has a slate roof on steel roof-trusses. It is 79 feet by 100 feet inside the walls and is divided by a 24-inch brick partition into engine room and boiler room, each 79 feet by 52 feet. The power house is provided with a traveling crane of 53 feet span, the dividing wall being reduced in thickness to accommodate this length of span. The boiler room is equipped with two batteries of four boilers each. The boilers are of the horizontal type and are 72 inches in diameter, 19 feet long, with 140 three inch tubes. Each boiler has a nominal rating of 185 hp, but will generate 360 hp at 125 pounds steam pressure. The flues enter a 115-foot circular brick stack, 13 feet in diameter at the base. This stack was put up in 11 days and six hours.

The engines are two in number, and are horizontal tandem compound Greene engines erected by the Providence (R. I.) Steam Engine Company. The shafts are 18 inches in diameter and carry fly wheels 18 feet in diameter, each weighing 32 tons. The engine can be operated either non-condensing or condensing, and are furnished with automatic safety stops and steam closing mechanism.

The electrical generators are direct-connected General Electric 10-pole machines having the armature spider keyed to the engine shafts. They are wound for a pressure of 600 volts at no load and 700 volts at full load, and are rated at 500 kilowatts at 100 revolutions per minute. The fields are of cast steel and the armatures are of the iron-clad type, each winding being insulated and then imbedded in an insulated slot in the laminated iron armature body. The ten brushes are all operated simultaneously by a hand wheel, and are arranged to secure the most perfect contact with the commutator.



EXPRESS TRAIN.

The switchboard is placed in front of the engines, and is built up of two standard General Electric generator panels set one upon each side of a third panel carrying a form "G" recording wattmeter showing the entire output of the station. Each generator panel carries a K automatic circuit breaker and the usual indicating and measuring instruments and switches for the power as well as the lighting circuits. From the switchboard the current passes along a lead-covered cable, set in a 3½-inch drain pipe in concrete, to a junction box at the foot of the nearest pole up which it is carried in an iron pipe to the longitudinal feeder.

The motor cars are of two types, the closed and the open. The closed cars are heavy baggage cars, and four are already equipped for service. The open cars are 16 reversible bench cars, and six are now receiving their equipment. The open cars resemble the familiar city trolley car, but have a flight of three continuous steps or foot boards by which admission is gained to the car.

The closed motor cars are 42 feet long over all, and are built extra heavy, weighing each, when fully equipped, over 30 tons. Two of the four ordered will have two motors on one truck, while the two others will have four motors, two on each of the two trucks. The open motor cars will be equipped with two motors each. The motors used are the General Electric 2,000 machines, especially designed for heavy work, and are similar to those in successful use in the Metropolitan Elevated Railway, in Chicago. They are watertight and fireproof. The drawbar pull of the two-motor motor cars is 4,000 pounds, that of the four-motor motor cars 8,000 pounds, the motors being 100 hp each, or 2,000 pounds horizontal drawbar pull through a 33-inch wheel. The current is taken from the wires by means of a trolley provided with a wheel having an extra deep channel to the motors through a General Electric series parallel controller, set up on the right-hand side of the platform. This controller is known as Type L and is somewhat larger than the K^2. It embraces the magnetic blow-out principle and all the other excellent features of the K^2. The resistances are suspended beneath the car. Two controllers are provided for each car.

Immediately at the left of the controller is the air-brake handle. The compressed air for the brakes and whistle is furnished by an oscillating cylinder air-compressor operated by an electric motor which is controlled by a special automatic rheostat regulating the action of the motor in accordance with the pressure in the tanks. A magnetic cut-out is also provided for the air-compressor motor. In the case of the closed cars the air-pump is set just within the door, in the open cars it stands on the platform to the extreme left of the motorman.

Behind the motorman and just under the hood is the car cut-out, which in this case is an automatic circuit breaker similar in type to that used on the generator panels in the station. Two 15-inch gongs are furnished to each car and are rung by the foot, and on one side near the centre of the car on the roof is a chime whistle operated by compressed air. The open cars are lighted by 18 incandescent lamps and the baggage cars by six. Each motor has a small pilot or cow-catcher placed beneath the platform. A feature of the line construction is the system of interlocking switches by means of which the overhead switch is thrown at the same time as the track switch.

The trains will be run as accommodation or express, the express trains consisting of a baggage motor car, with open trailers, the accommodation facilities being furnished by single motor cars. The traction weight of the baggage will be increased by the baggage they will carry, and the light trains should be operated without difficulty. At Pemberton station the cars will run with the baggage car at the head. The motor car will then uncouple switch and run back to the head of the train, the motorman changing platforms.

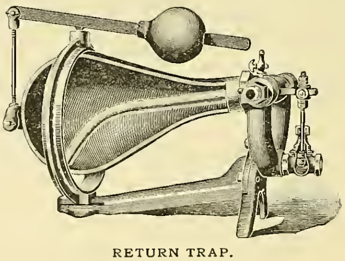
Everything in the installation has been done upon the personal initiative of the president of the road, Chas. P. Clark. The electrical installation was effected on the plans laid out by Col. N. H. Heft, who personally supervised the work. The tests made on this line are of interest. The first showed that the motor car alone or with a small load could run at a higher speed than that attained by ordinary express locomotives, and maintain the speed without difficulty. Subsequent tests were made with the locomotive or motor car as a freight hauler and not less than 15 heavily-loaded freight cars were easily moved and carried along the line at a high rate of speed.

The crucial test was made on the 27th of June, when, under Division Superintendent J. C. Sanborn's care, a party was taken over the line. A special train of two passenger cars was made up and hauled as far as Nantasket Beach Junction by a steam locomotive, which was uncoupled at this point and its place taken by one of the two motor baggage cars. The coupling was effected without shock, and the train moved off in the direction of the power house without jerking on the couplings and considerably more smoothly than would have been the case with a steam engine. While examining the power house, a call brought the guests to the windows in time to see a long train consisting of a motor car, about 30 gravel cars, fully loaded, and a brakeman's van, go flying by at 40 miles an hour in the direction of Nantasket Beach.

After the inspection of the power station the company re-embarked and Colonel Heft stationed himself at the controller. In a few moments the train of three cars swept at 40 miles an hour in a blinding rainstorm toward Pemberton station. On the return journey Colonel Heft threw over the handle of the controller when the train came to the straight stretches, and the motors responded in a quiet, effective way, sending the train whirling along down the wet track at a speed of over 50 miles an hour. The line was opened for regular passenger traffic with the electric car on Sunday, June 30.

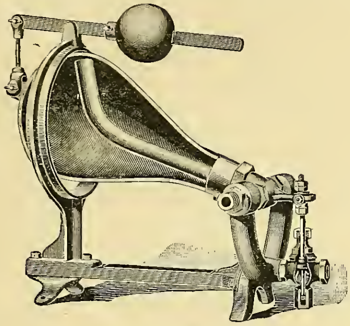
Bundy Steam Traps.

The Bundy steam traps are shown in the illustration. The return trap is designed for returning the water of condensation to a boiler against any pressure of steam. The tank trap is provided for discharging water into a tank or into the atmosphere. It is claimed for these traps that they are simple in construction, durable, easily cared for, posi-



RETURN TRAP.

tive in operation, economical in respect to saving steam, and quick in action. All the parts are readily accessible. No floats or buckets are used and there is no interior mechanism. It is stated that with reasonable care the traps cannot get out of order, and it is easily adjusted to varying conditions and quickly connected up in place. The return trap, it is stated, operates against any pressure in the boiler, and the tank trap will lift water two feet for every pound of steam pressure used. All necessary packing can be done without taking the trap apart It has no flanged connections or bolted joints. All joints are screw-thread connections which are claimed to be superior. Each trap is thoroughly tested to 300 pounds pressure before being shipped. The Bundy steam traps are manufactured by the A. A. Griffing Iron Company, of New York.



TANK TRAP.

Comments and Views of Contemporaries.

GOOD MANAGEMENT AND ACCIDENTS.—We believe that careful management has much to do with the number of fatalities which may occur on an electric railway. In this city there have been but three trolley fatalities in six years, and every line in the city is a trolley line. The cars have not been equipped with fenders because the managers do not believe that a practical device has as yet been invented, but they do exercise due caution in regard to the speed of cars, and the care which motormen must exercise on frequented streets and crosswalks. —*Binghamton Herald.*

FENDER STATISTICS.—Every accident in which the fender plays any part, good or bad, should be reported by the car companies to the Department of Public Safety, with the names of witnesses and descriptions of the fenders. Then in a little time we should know what value to put upon the different styles. Theoretically each kind of fender is useful in some kind of accidents—and all, or nearly all, of them will probably fail as life savers under certain other conditions. It is only by observation of them in actual work that anything of value can be learned about them. The fatal accidents will get reported, but much more can be learned from the accidents in which lives are saved than from those in which the fenders fail to work. Something should be done to gather trustworthy statistics on the subject. —*Philadelphia Public Ledger.*

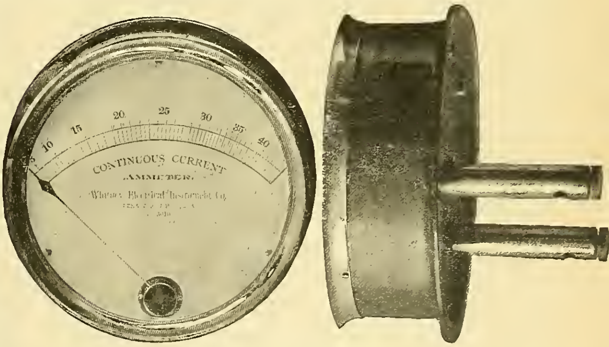
FREIGHT ON ELECTRIC LINES.—Although the late legislature was very liberal in its treatment of the traction roads, it did not pass a proposed law permitting them to carry freight. Such a bill was talked of early in the session, but on account of the opposition of the steam railways, it is understood that the measure was dropped for the present. There can be little doubt, however, that eventually this power will be granted. The trolley is spreading out in all directions over the State, connecting towns which heretofore were restricted to facilities offered by the railways. If the latter can make money carrying the lowest grade of freight, as ore, coal, coke, etc., the traction companies should make more money carrying lighter freights which now go to the express companies, who must divide their profits with the transportation companies. —*Pittsburg Chronicle-Telegraph.*

CONDUCTORS' PERIL.—One of the hardships which conductors on the trolley railways are now obliged to undergo is the almost continual walk around on the narrow side platforms of the open summer cars. We saw one of the conductors of the Peoples' Traction Company knocked off and almost killed while collecting fares, by being struck in the back with the pole of a heavy wagon. It is a great wonder that more of the men do not miss their hold on the framework of the cars as they pass from row to row or lose their footing on the small ledge. The companies should have more consideration and build cars which will not require conductors to go into practice as acrobats in order to get around them and collect fares. This style of cars is also clumsy and awkward to passengers as well, especially to ladies and old people who are often put to much annoyance and nervousness in getting in and out. Why is it that all the summer cars cannot be built on the model of some on the Fifth and Sixth Street Railway, with double seats only and an aisle running up the middle?—*Philadelphia Times.*

Ironclad Voltmeter and Ammeter.

The switchboard ammeter for direct current shown in the accompanying cut is manufactured by the Whitney Electrical Instrument Company, of Penacook, N. H. The instrument is of the familiar circular-case form which has become so generally liked throughout the trade, and it is provided with rear lugs for connecting behind the board.

These instruments are guaranteed to be accurate within 1 per cent., and are encased in iron so as to obviate interference from extraneous sources and to allow the instruments to be placed as near each other as may be desired without exerting mutual influence. They are handsomely finished in black enamel, with nickel trimmings, and fully come up, in design, workmanship and material, to the high standard characteristic of the products of this company. The voltmeter is identical, in principle and appearance, with the ammeter, both being designed to meet the great demand for an inexpensive yet reasonably accurate and wholly reliable instrument for switchboard service.



IRONCLAD AMMETER.

FINANCIAL NOTES.

RECEIVER APPOINTED IN LOGANSPORT.—D. D. Fickle has been appointed receiver of the Logansport (Ind.) Street Railway Company.

GILBERT CAR WORKS SOLD.—The Gilbert Car Works, of Troy, N. Y., have been sold for $72,000 to representatives of the Atlantic Trust Company, of New York, which held a mortgage amounting to $79,000 on the plant. The estimated value of the works is $400,000.

REORGANIZATION OF MILWAUKEE COMPANY.—In his annual report President C. W. Wetmore, of the North American Company, which controls the Milwaukee Street Railway companies, says that the success of the plan of reorganization for the latter company is assured.

RECEIVER FOR THE SCHUYLER ELECTRIC COMPANY.—Ex-Congressman Lewis Sperry has been appointed receiver of the Schuyler Electric Manufacturing Company, of Hartford. The Schuyler Electric Manufacturing Company sold its assets, including patents, to the Schuyler Electric Company, of Middletown. The Supreme Court has decided that the sale was illegal, hence all the assets must be returned to the former company.

BRIGANTINE BEACH RAILWAY SOLD.—The Brigantine Beach Railway was sold in Atlantic City, N. J., at foreclosure sale on June 27 by Receiver Howard Carrow, of Camden. The road was bought in by George H. Cook, of New York, acting for the old bondholders, the price paid being $51,000. A new company will be organized, under a new name, and the road will be extended to Egg Harbor City, where a terminal will be built midway between the Reading and Pennsylvania stations.

UNPAID STOCK SUBSCRIPTIONS.—H. B. Thompson, as receiver of the property of the Steubenville Street Railway Company, of Ohio, and several judgment creditors of that company, have brought suit in New York to recover from the original stockholders of the company the amount of their unpaid subscriptions to the capital stock, so that if any sum is recovered it may be devoted to the payment of claims of creditors. Among those who were the originators of the company are Maurice B. Flynn, Richard S. Newcombe and Francis L. Wellman.

CONSOLIDATED TRACTION COMPANY OF NEW JERSEY.—The Consolidated Traction Company of New Jersey has turned in to the City Comptroller, of Newark, 5 per cent. of the gross earnings of its various divisions operated by electricity for the year ending April 30, 1895. It amounts to $39,234.42. This is a large increase over the company's payments of previous years. In the first year, 1893, under the city ordinance which became operative for the first time in that year, requiring street railway lines using electricity to pay into the city treasury, annually, 5 per cent. of their earnings, the Consolidated Traction Company paid in $16,077.88. Last year its returns amounted to $15,079.77.

LEWIS & FOWLER CONSOLIDATION.—The Lewis & Fowler Manufacturing Company and the Lewis & Fowler Girder Rail Company, of Brooklyn, have again voted to consolidate. The companies decided to unite by a majority vote some weeks ago, but a second meeting was necessary as a two-thirds vote is required by law. The new company will be known as the Brooklyn & New York Railway Supply Company, and will have a capital of $200,000 with bonds to an equal amount. The stockholders of the manufacturing company will receive one share of the new capital stock for three of their old shares and those of the Girder Rail Company one share for two of the old. The old manufacturing company had a capital stock of $300,000, and the rail company of $200,000. The takers of the new stock will have the right to subscribe for the bonds and the money received from the sale of these will be used to put the companies on their feet.

NEW INCORPORATIONS.

THE MICHIGAN CITY & LA PORTE STREET RAILWAY COMPANY, La Porte, Ind., has been incorporated by H. B. Tuthill and others. The capital stock is $25,000.

THE INTERURBAN RAPID TRANSIT COMPANY, Tiffin, O., capital stock $250,000, has been incorporated by Mescheck Frost, Amandus Betts, Norman McCarty and others.

THE DALLAS RAPID TRANSIT & TERMINAL COMPANY, Dallas, Tex., has been organized by B. S. Wathen, A. F. Hardie and others to build an electric road in the city and vicinity.

THE IDAHO SPRINGS & BELLEVUE MOUNTAIN TRAMWAY COMPANY has been incorporated with a capital stock of $60,000. The incorporators are James W. Swem, Milo M. Slater, Jas. A. McClurg and Ed. F. Lachner.

THE ATCHISON RAILWAY, LIGHT & POWER COMPANY, capital stock $200,000, has been formed to build an electric street railway and to supply light and power. Those interested are James W. Orr, R. B. Morris, E. C. Post and R. L. Pease.

THE BADT MULTIPHASE ELECTRIC RAILWAY COMPANY, of Chicago, Ill., has been organized by Wm. A. Aylsworth, Jas. C. Essick and Adolph Gray. The capital stock is reported as $1,000,000 and the object is to promote, build, buy and sell electric railways, etc.

THE McKEESPORT & PORT VUE PASSENGER RAILWAY COMPANY, capital stock $18,000, has been incorporated at McKeesport, Pa., to construct and operate an electric railway at McKeesport. Promoters, R. T. Carothers, T. D. Gardner and J. W. Allig, McKeesport, Pa.

THE C. J. FIELD COMPANY, New York, has been formed by Cornelius J. Field, of Brooklyn; Frank Bourne, of Mt. Vernon, and John W. Gilmore, of New York, to conduct an electrical and mechanical consulting engineering business. The capital stock is reported as $4,000.

THE PORTLAND SUBURBAN RAILWAY COMPANY, Portland, Ore., capital stock $2,500,000, has been incorporated to operate a city and suburban railway to be operated electrically or otherwise, etc. Jas. M. Lively, Ezra D. Baker, Portland, Ore., and L. D. Lively, of Athens, Ore., are interested.

THE BUFFALO, NORTH MAIN STREET & TONAWANDA COMPANY, Buffalo, N. Y., capital stock $75,000, has been formed to operate the Buffalo, North Main Street & Tonawanda Electric Railway Company. S. W. Petrie, T. H. Feary and J. H. Pardee, Buffalo, and J. F. Farrell, Albany, N. Y., are interested.

THE DALLAS CITY STREET RAILWAY COMPANY, Dallas, Tex., has been incorporated with a capital stock of $500,000, to construct and maintain a street railway in Dallas to be operated either by horse, electric or cable power. The promoters are Frank Clark, Baltimore, Md.; C. L. Blackford, Denison, Tex.; I. L. Sale, Dallas, Tex.

TOWSON, MD.—A stock company has been formed by Geo. S. Metter, Dr. W. Crim, S. J. Carr, of the Carr-Lowery Glass Company, and Wm. F. Porter, of Johns & Porter, and others, for the purpose of building an electric railway to connect Mt. Winans, Westport, Lansdowne and Metter's Park with Baltimore. The capital stock is $75,000.

THE EAST LORAIN STREET RAILWAY COMPANY, Lorain, O., has been incorporated with a capital stock of $25,000, to construct, own and operate street railways in the village and county of Lorain, and in Cuyahoga County, electricity or other motive power to be used in operation; and to supply electric light, heat and power. Incorporators, William J. Carone, Wm. McReynolds, John W. McReynolds, John A. Park and Edward S. Meyer; the last named of Cleveland, O.

NEWS OF THE WEEK.

TOWANDA, PA.—A new electric road is to be constructed.

OWASSO, N. Y.—It is proposed to extend the electric railway here.

PLANT CITY, FLA.—It is rumored that another railway line to Bartow is to be built.

HOLYOKE, MASS.—The question of an electric line from Holyoke to Hartford, Conn., is now revived.

BATH, N. Y.—The building of an electric road to Hammondsport is believed to be an assured thing.

CHICAGO, ILL.—The Chicago & Northern Pacific has decided to equip its suburban lines with electricity.

BOSTON, MASS.—The West End Street Railway Company has just purchased a site for a new car house in Allston.

GIRARD, ALA.—A new electric street railway line will soon be completed which will connect Girard and Phœnix City.

GENEVA, N. Y.—The local electrical railway company has secured a right of way for the extension of its line.

HUMBOLDT, TENN.—A company is being organized to build an electric road from Humboldt to Alamo, a distance of 18 miles.

MONONGAHELA, PA.—The Monongahela Street Railway is to be built at once to extend from Courtney to Black Diamond.

GENEVA, N. Y.—The right of way for an extension of the electric railway, making a belt line about the town, has been secured.

LEICESTERSHIRE, N. Y.—Governor Morton has approved the act authorizing the extension of the trolley from Leicestershire to Union.

CHICOPEE, MASS.—The Chicopee Street Railway Company is seeking a franchise to build and operate its tracks to Wymanlea Avenue.

ROCKDALE, TEX.—J. R. Rowland is interested in the proposed electric railway, for which several power plants will probably be built.

MIDDLETOWN, N. Y.—There is a strong probability that the trolley road from Middletown to Montgomery will be completed this year.

SYRACUSE, N. Y.—The Syracuse Street Railway Company has been granted a franchise to construct a double-track line to Onondaga Valley.

MONTREAL, QUEBEC.—The residents of Lonque Pointe have petitioned the Montreal Park & Island Railway Company to extend its line to Lonque Pointe.

SAUGERTIES, N. Y.—Opportunities are open to capitalists to build an electric road from Saugerties connecting Quarryville, Katsbann and West Saugerties.

BALTIMORE, MD.—The Canton, Sparrow's Point & North Point Electric Railway will probably build a power house of 1,000 hp. F. W. Wood is interested.

CUMMINGSVILLE, O.—A company is to be formed to construct an electric street railway from Cummingsville to Mt. Airy. The capital stock will be $100,000.

NORFOLK, VA.—A company is considering the plan of building an electric road from Berkeley along the eastern branch of the Elizabeth River by way of Kempsville.

BALTIMORE, MD.—A company is to be incorporated for the purpose of building an electric railway to Meeter's pavilion, Westport and other villages in the southern section.

BALTIMORE, MD.—The Sinepuxent Beach Railway Company will in the near future complete its plans for an electric railway along the beach the entire length of its property.

NEWBURYPORT, MASS.—The Board of Aldermen has granted the People's Street Railway Company an extension of time in which to build a line through Storey Avenue to West Newbury.

BOSTON, MASS.—The Board of Railway Commissioners has granted the petition of fifty residents of Kingston and Plymouth asking for a reduction in fares on the Plymouth & Kingston Railway.

NYACK, N. Y.—The Nyack Traction Company, of which F. R. Bain, of Poughkeepsie, is president, will begin the construction of an electric railway between Nyack and West Nyack, within a few days.

BALTIMORE, MD.—The City & Suburban Railway Company, Nelson Perin, president, is planning an extension two and a half miles long from its Catonsville branch to Bonnie Brae Cemetery in the suburbs.

WAUKESHA, WIS.—The electric line uniting Waukesha with Pewaukee Lake was formally opened June 25. Speeches were made by Gov. Upham, ex-Gov. Peck, T. W. Haight and Mayor Koch, of Milwaukee.

PITTSBURG, PA.—The work of grading has been commenced east of Brinton and through the borough of Turtle Creek for the building of the extension of the Second Avenue Railway between East Pittsburg and Wilmerding.

WINCHESTER, TENN.—D. C. Rice, J. L. Girton and others are making arrangements to build an electric railway from the Tennessee River to the property of the Tennessee & Alabama Land, Mining &'Railway Company.

NEW YORK, N. Y.—Judge McAdam, of the Superior Court, has granted a temporary injunction restraining the 23d and 29th Street Railway Company from taking any steps for the construction of its railroad in 29th Street between 11th Avenue and First Avenue.

TUCKAHOE, N. Y.—The probabilities are strongly in favor of a trolley line from Tuckahoe and Bronxville to White Plains and Mt. Vernon. The new line will be an extension of the North Mt. Vernon Railway in which John D. Crimmins is largely interested.

NEW YORK, N. Y.—The management of the Metropolitan Traction Company has written to the postoffice department that it does not care to carry mails on the Broadway line in accordance with the proposition which has been made. The compensation is regarded as insufficient.

BALTIMORE, MD.—George S. Kieffer and William F. Porter presented to the Baltimore County Commissioners last week an application from the Baltimore, Westport & Lansdowne Electric Railway Company to construct and operate an electric line, with single track, in the 13th district of the county.

BALTIMORE, MD.—The Canton, Sparrows & North Point Railway will be eight and one half miles long, equipped with the trolley system. The company is considering whether or not to build its own power house. If built, an equipment of at least 1,000 hp will be needed. F. W. Wood is a director.

PORTLAND, ORE.—The Barnes Heights & Cornell Mountain Railway Company is again considering the question of extending the electric road to Hillsboro, a distance of 10½ miles, and a branch line to Beaverton, a distance of two and one half miles. Nelson, Nelson & Co., of Portland, are interested.

ROCK ISLAND, ILL.—Samuels & Chapman, of Moline, have petitioned the Board of Supervisors of Rock Island County, for the right of way through South Moline township, to lay the necessary track and operate from the present terminus of the Central Street Railway at Prospect Park to Rock River Bridge.

SOUTHBRIDGE, MASS.—There is a movement in progress to construct a railway to connect Southbridge with the Boston & Albany at East Brookfield. There are also parties who stand ready to build an electric road from Sandersville through Southbridge. The Southbridge Board of Trade can probably give information.

KANSAS CITY, MO.—The ordinance extending the franchises of the Metropolitan Street Railway Company so that they will expire in 30 years, in consideration that transfers upon all its different lines be granted, is now a law. It passed both Houses of the Council last week over Mayor Davis' veto, with but one negative vote in each House.

NIAGARA FALLS, N. Y.—William Kyle, of Toronto, is promoting an international trolley belt line. He proposes to construct an electric road touching various points on the Canadian side, and then crossing a bridge and connecting with the local system. He proposes to get his power from the Niagara Falls Hydraulic Power & Manufacturing Company.

CHICAGO, ILL.—Judge Tuthill has dissolved the injunction obtained by John W. Doane against the Lake Street Elevated Railway to prevent the latter company from erecting its structure in front of the complainant's property at Lake Street and Wabash Avenue. Mr. Doane's counsel took an appeal from the decision of the court to the Appellate Court.

CHATTANOOGA, TENN.—The Lookout Mountain Incline & Lula Lake Railway Company has commenced work on its proposed road. The incline will be 4,700 feet in length and will extend from the terminus of the Chattanooga Electric Railway to Lookout Inn. The cars will be drawn by cable. The president and manager of the company is J. F. Cross.

CHICAGO, ILL.—A street railway franchise has been granted by the Council for a line to open up the northern section of the city. The Chicago Passenger Traction Company is the name of the company and two of its chief promoters are Judge Gibbons and P. H. Hoyne. Work will be begun at once. Electricity, supplied by overhead wires, will be the motive power.

BROOKLYN, N. Y.—Assistant Corporation Counsel Angel has instituted three test cases of violations of the speed ordinance, one each against the Brooklyn Heights Railroad Company, the Atlantic Avenue Railroad Company and the Brooklyn City & Newtown Railroad Company, to recover the penalties of $25 each. These are three of more than 200 alleged violations.

GREENSBURG, IND.—Local capitalists are discussing the advisability of building an electric road from Greensburg to Clarksville, a distance of 12 miles, by way of Kingston. B. S. Sutton and K. Hord, of Shelbyville, and others interested in the Ogdensburg & Batesville Electric road, are the promoters of the enterprise. Jacob Emmet and T. H. Stevenson, of Greensburg, are also interested.

INDEPENDENCE, MO.—The Council has granted the Electric Street Railway Company franchises for the location of tracks on South Main Street to Alden Avenue, and on Alden Avenue east to Clarendon Place. Conditions were added, however, that the work must be completed within one year, and that the line from Alden Avenue to South Side Boulevard must be finished within three years.

BROOKLYN, N. Y.—The presidents of the several street railway companies have united in an application to Mayor Schieren for an extension of four months in the time specified in the ordinance requiring them to fit their cars with life-saving fenders. They claim that it is impossible to obtain proper contrivances within the specified time. They also ask for an increase from eight to 10 miles an hour in the speed limit in the outlying districts.

CROWN POINT, IND.—It is announced that a syndicate is to be formed to build an electric railway giving Chicago connection with six Indiana towns in Lake County. The line as proposed is to run from Hammond to Crown Point and then six miles west to St. John, still westward six miles to Dyer, then five miles south to Cedar Lake, Lake County's summer resort, and again southward six miles to Lowell, in all making a distance of 50 miles.

BALTIMORE, MD.—W. L. Elkins, P. A. B. Widener and Thomas Dolan, of Philadelphia, had a conference last week with the officials of the Baltimore Traction Company in reference to the Columbia & Maryland Boulevard line. It was decided to give out immediately additional contracts for construction of the stone ballasted electric road to Washington and to push the road as rapidly as possible. It is hoped to have the road between the two cities in operation by October 1.

WASHINGTON, D. C.—The stockholders of the Washington & Great Falls Electric Railway Company have elected the following directors: J. P. Clark, S. T. G. Morsell, C. A. Maxwell, J. V. N. Huyck, Smith Pettit, F. H. Stier and W. E. Lewis. The directors elected the following officers: J. P. Clark, president; S. T. G. Morsell, vice-president; Lee Hutchins, treasurer, and W. E. Lewis, secretary. The contract for the construction of the road will be let, and work commenced at once.

CHICAGO, ILL.—Ordinances have been introduced in the City Council to allow the Chicago City Railway Company to operate the following horse-car lines by electricity: Archer Avenue, from the river east to the intersection of State Street; Clark Street, from Washington Street to 22d Street, thence to Wentworth Avenue; in Ullman Street; Halsted Street, from O'Neill to Archer Avenue; in 22d Street, from Indiana Avenue to the river; in Dearborn Street; in 31st Street, from State Street to Cottage Grove Avenue.

MONTREAL, QUE.—Duncan McDonald, superintendent of the Montreal Street Railway Company, as representative of the company has been sued for $500,000 damages for alleged breach of agreement. The plaintiff in the case is Frederick Roche Alley, real estate agent of Montreal. It is claimed that on May 20, 1893, the company, through H. A. E. Everett, then managing director, and Grenville C. Cunningham, undertook to construct an electric car service from the city along the line of St. Denis Street to Back River for certain considerations which Mr. Alley was ready and able to fulfill, but that the company since then has ignored the arrangement to the great loss of profit to Mr. Alley.

MILWAUKEE, WIS.—About 140 men employed in building an extension of the tracks of the Milwaukee Street Railway Company to the State Fair grounds, struck for increased pay on June 24. Receiver Henry C. Payne was immediately informed of the strike, and after holding a short consultation with Judge Jenkins in the United States court room, made application at the marshall's office for six deputies to aid in maintaining order and to prevent the striking workingmen from interfering with those who desired to proceed. The strike was settled as soon as the deputy marshals appeared on the scene. Out of the 140 men 30 were peremptorily discharged. The remainder went back to work as if nothing had occurred.

CHICAGO, ILL.—G. W. Van Zandt, President of the Brandenburg Under-Car Electric Railway Company, has written an open letter to the City Council protesting against the use of overhead wires in the business district. He makes the proposition: "We will equip the Clark Street Line where they propose to put in the overhead trolley, with an underground system, using a slot only one fourth of an inch in width, and will build it for the City Railway Company without cost to them until it has proven beyond a question to the world that it is as good or better than the overhead trolley, and then when they do pay for it they shall only pay the cost of the overhead trolley line. The money to do this will be forthcoming from the most prominent citizens of the city of Chicago, who have examined our system and know all about it."

PERSONAL.

MR. ROBERT C. BROWN has resigned the position of electrical engineer o the Montreal Street Railway Company to accept that of manager of the Halifax Electric Street Railway Company of Halifax, Nova Scotia.

MAX A. BERG has resigned his position as secretary of the Wallace Electric Company, of Chicago. Mr. Berg will take a well-earned rest, and no doubt will become associated with the electrical industries again in the near future.

MR. A. J. SHAW, of the Shaw Electric Crane Company, died recently of peritonitis at his home in Muskegon, Mich. Mr. Shaw was formerly associated with the E. P. Allis Company, of Milwaukee, and while connected with that company developed the electric crane which is known by his name.

TRADE NOTES.

AN ICE CONTRACT has been secured by the Louis K. Comstock Company, 1437 Monadnock Block, Chicago, for the complete equipment of a six-mile electric road at Pontiac, Mich., including steam plant, cars and overhead equipment.

THE A. A. GRIFFING IRON COMPANY, of 15 Dey Street, New York, which manufactures the Bundy return and tank steam traps, publishes an explanatory book concerning them entitled "X Y. Z." It will be mailed to those who apply for it.

AN ELECTRIC PUMPING PLANT, to consist of one 10 x 12 in. Goulds triplex power pump, driven by an electric motor and having a capacity of 500 gallons per minute, has been sold by the Gould Company, 22 North Canal Street, Chicago, to the City of Oregon, Ill.

THE AMERICAN ELECTRICAL WORKS have sent to their friends recently a souvenir appropriate to the season. It is in the form of a sky rocket, the compartment usually reserved for the explosive containing in this case an American flag, and reading matter calling attention to the Fourth of July as well as to the wires sold by the company.

CONSULTING VERSUS CONTRACTING.—Field & Hinchman, heretofore at 29 Clifford Street, Detroit, decided last February to give up contract work and devote themselves entirely to consulting and supervisory engineering, and report that their business has increased so fast as to necessitate moving into larger offices. They have accordingly taken quarters at 25 and 26 Hodges Building, where they will have ample room and facilities for their rapidly increasing work.

THE ELECTRICAL ENGINEERING COMPANY, Minneapolis, Minn., has secured, for a term of years, the northwestern representation of the Siemens & Halske Electric Company of America. Mr. Morgan Brooks and those associated with him in the Electrical Engineering Company have earned a reputation for enterprise, fairness in business matters, and courteous treatment of customers, and the Siemens & Halske Company is to be congratulated upon having secured such a worthy representative for so important a territory.

E. L. BARR, well known to the trade through his former connection with the Canadian General Electric Company, and more recently as traveling salesman for the Wallace Electric Company, takes the place of Max A. Berg, who has just resigned as secretary of the latter company. The company is closing out its merchandise business and in future will devote itself exclusively to the interests of the manufacturing companies, of which it is western representative. Its line embraces electrical material and specialties of all kinds.

THE TRUTH, THE WHOLE TRUTH, ETC., is what the Hogan Boiler Company of Middletown, N.Y., claims to be the statements contained in its pamphlet entitled "Truths," in which are presented sectional illustrations of the Hogan water-tube boilers and a number of exceedingly strong claims for them, one of which is that, owing to the peculiar construction of the boilers, no scale is formed in them. Very strong arguments are made to show the advantage of curved over straight tubes and some interesting comparisons are drawn between the performance of this and other water-tube boilers.

THE BROWNELL CAR COMPANY, of St. Louis, Mo., has just issued a volume entitled "How a Good Car Differs From a Poor One and How to Get It." The book is designed to be a car buyer's helper and it serves its purpose admirably. The volume explains in simple terms the principles upon which a car designed for the trying conditions of street railway service should be based. It also points out the consequences of departures from the best methods of construction. The purpose of the publication is to show how the principles are embodied in the "Accelerator" cars, built by the Brownell Car Company, but it should not be considered solely as an advertising volume. It contains information of great value to those who are interested in car construction—information which it is not the easiest thing in the world to find elsewhere. The book is worth having and worth keeping, as perhaps the most interesting treatise available on street car construction.

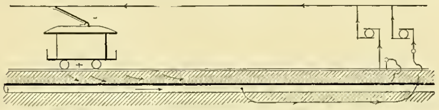
THE OHIO BRASS COMPANY, manufacturers of electric railway supplies, Mansfield, O., has just issued a handsomely printed, profusely illustrated and well-arranged catalogue known as their "No. 3." The guiding hand of Mr. C. K. King, of the Ohio Brass Company, can be traced throughout the catalogue Mr. King is a thoroughly practical electric railway man, being experienced not only in the manufacture of railway material, but also having the advantage of experience in electric railway construction and operation. In preparing catalogue "No. 3" it was Mr. King's aim to eliminate all unnecessary and unsatisfactory material, and to present in plain and concise form what he considered the latest and best in electric railway appliances. Within its pages are described: Poles, iron, steel and wooden; pole tops, arms and brackets; numerous new types of trolley wire hangers and insulators, different styles of trolley wire clamps; numerous styles of switches and cross-overs; the "Ohio" trolley, trolley wheels, and, in fact, almost everything needed for the construction or operation of electric roads. It is understood that electric railway men can secure a copy of this catalogue by writing for it.

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED JUNE 25, 1895.

541.466 AUTOMATIC LIFE GUARD FOR CARS; Clara M. Beebe, Elmira, N. Y Filed Oct. 6, 1894. The guard comprises a buffer with a pneumatic cushion upon it, and rearwardly extending arms mounted on wheels. Hangers, which are suspended from the car, are adapted to support the buffer arms, which carry a suspending rod. A basket is yieldingly hung from the suspending bar and has a yielding connection with the front ends of the buffer arms.

541.467. METHOD OF PREVENTING ELECTROLYSIS OF PIPES UNDERGROUND; Harold P. Brown, New York, N. Y. Filed Dec. 10, 1894. This method of preventing the electrolytic decomposition of underground pipes by the connection of escaping currents on street railway circuits consists of maintaining the pipes in a negative condition in respect to the rails, by connecting the pipes to the negative pole of a dynamo of higher potential than the dynamo to which the rails are connected. (See Illustration.)



No. 541,467.—METHOD OF PREVENTING ELECTROLYSIS OF PIPES.

541.468. CAR FENDER; Robert Bustin, St. John, Canada, assignor of five sixths to Robert Keltie Jones, same place, and Wesley Vanwart, and John R. McConnell, Fredericton, Canada. Filed April 17, 1895. The fender, which is detachable and folding, consists of side arms adapted to be detachably hinged at their rear ends to brackets carried by the car. There is an upper cross-bar for detachable connection with standards which are permanently supported on the brackets. A lower and forward cross-bar is secured to the forward ends of the side arms and on it a pneumatic cushion or buffer is supported. Flexible side stays connect the upper and lower cross-bars and are adapted to regulate the distance between the bars and give any required inclination to the sidearms. A netting or yielding covering is connected to and supported by the bars and stays. The fender is adapted for folding upward while connected with the car, and the netting may be rolled on the upper cross-bar when the fender is detached.

541,500. ELECTRICAL CONTROLLER FOR MOTORS; Oscar H. Pieper and Alphonse F. Pieper, San Jose, Cal. Filed April 30, 1894. The controlling device combines a main casing, a rheostat, a horizontal moving pedal, lever and return springs therefor, a switch bar and an insulated brush slit into two limbs. The limbs form electric connection between two separate commutators or rheostat plates and insulated segments are attached thereto, so that by the rotative movement of the switch bar the return current will be reversed, and the motive apparatus to be controlled driven in either direction.

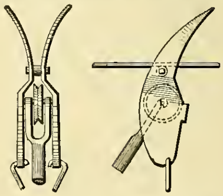
541,577. CAR FENDER AND SNOW CLEANER; Charles A. Smith, Philadelphia, Pa., assignor of two thirds to Benjamin W. Grist and William K. Schoderer, same place Filed Nov. 21, 1894. The car is provided with depending supports, two spring-mounted plates being pivoted upon the supports in such a manner as to be swung forward at an angle to each other and secured at their adjacent ends. The plates are normally held clear of the track by means of springs. A cross-beam is loosely mounted on the supports, and a lever engages the cross-beam, having at its forward end a foot piece or depressor extending upward through the opening in the car platform.

541,662. ELEVATED RAILWAY; Robert M. Fryer, Washington, D. C. Assignor to the International Construction Company, of Arizona. Filed Feb. 20, 1895. This is the combination in a continuous track for elevated railways of a rod or casing with elevated supports therefor. Grooved or channeled rails have their side flanges extending below the same and connecting bars or saddles are secured in the channel of the rail below the cable and there are pivotal connections between the saddles and the elevated track supports.

541,663. ELEVATED RAILWAY; Robert M. Fryer, Washington, D. C., assignor to the International Construction Company, Arizona. Filed Feb. 20, 1895. Supports extend above the sides of an elevated track on opposite sides of it, and are united at the top. A suspensory cable is mounted on the supports centrally above the track, and connections between the cable and track sustain the latter from the former. There are stays between the track and the upper end of the support, the stays diverging from their points of attachment with the supports toward the respective track rails, so that a lateral swaying of the track is prevented.

541,726. CAR FENDER; Frank W. Darling, Hampton, Va. Filed Jan. 30, 1895. A rigid frame comprising the rear scoop and the front cross-bar is arranged to contact with and be lifted by objects upon the track. There are pivotal connections between the frame and the car body, with means for engaging the frame after the scoop has been lowered by the upward movement of the cross-bar whereby the scoop is held normally against upward movement.

541,730. CONDUIT ELECTRIC RAILWAY; Edward Ebi, Cedar Rapids, Ia. Filed July 5, 1894. The trolley comprises oppositely projecting and pivoted arms with trolley wheels at the ends. Tooth gearing is provided between the vertical ends of the arms and the lower ends of the vertical rod which is mounted so as to turn. By turning the rod the arms may be raised or lowered.



No. 541,796.—TROLLEY FINDER.

541 770. CAR FENDER; Isaac Macowsky, New York, N. Y. Filed Jan. 3, 1895. Pedestals are provided for attachment to a car, and in them shafts are journaled. Gears connect the shafts, to one of which a fender is secured. A lever is connected to the other shaft, and a spring holds the fender in its normal position, means being provided for locking the latter.

541,771. CAR FENDER; George W. Mahan, Cold Spring Harbor, N. Y. Filed March 15, 1895. The fender comprises a skeleton framework projected forward from the car and turned up in front of the dashboard. It comprises a series of parallel bars, and has its edge and top surfaces cushioned. A rearward extension projects from the skeleton framework and is coupled to the car bottom. A single pair of supporting wheels is located near the centre of the fender, and is adapted to run on the track rails.

541,796. TROLLEY FINDER; James P. Taylor, Fort Worth, Tex. Filed March 12, 1895. The trolley guide which is pivoted on the trolley wheels consists of a piece of sheet metal having bearings for a spindle, a spool mounted on the spindle and a clevis mounted in the apertures in the guide. (See Illustration.)

Electric Railway Gazette.

Vol. XIII. NEW YORK, JULY 13, 1895. No. 2.

New Plants of the Electric Traction Company of Philadelphia.—II.

Each of the three 600-hp McIntosh & Seymour tandem-compound engines is directly coupled to a General Electric generator of 400 kw capacity. The generators are of the latest type manufactured by the company. The switchboard is of the slate panel type and extends nearly the entire length of the engine room. It is equipped with Thomson magnetic circuit-breakers and Weston ammeters and voltmeters. Double-quick break switches are used on all feeders. A 650-volt auxiliary bus bar is employed for maintaining the necessary voltage on the outlying lines. The engine room is equipped with a 15-ton traveling crane, built by the Brown Hoisting & Conveying Company, of Cleveland, O.

The generator leads are under the floor and extend to the cable vault located directly below the switchboard. In construction the vault is similar to that of the Delaware Avenue plant of the Electric Traction Company which was described and illustrated in the issue of June 22. The rheostats are located in the vault and are governed from the switchboard.

The plant will shortly be increased by the addition of two engines of the same type as that described, making the total capacity of the station 3,000 hp. When completed the plant will supply power to all the Electric Traction Company's West Philadelphia lines, the Tenth and Eleventh street lines and the South and Lombard street lines as far as Sixth Street. The plant was built under the supervision of Axel H. Engstrom, the company's constructing engineer.

New Car House

Figs. 2 and 3 show the elevation and plan of the repair shops and car house which the company is erecting at Kensington Avenue and Sergent and Jasper streets. The elevation, Fig. 2, is that on Kensington Avenue. The structure is of brick and its frontage on Sergent Street is about 390 feet, while that on both Kensington Avenue and Jasper Street is about 240 feet.

The structure is a subtsantial and commodious one, and has been admirably planned by the engineers. Every provision has been made so that cars can be readily transferred from one department to another and the repair work facilitated in every way.

Fig. 3 shows the arrangement of the repair shops and the location of the storage and transfer tracks. The main repair shops are located along the Sergent Street side of the building. The dimensions of the machine shop are 182 by 38 feet, those of the blacksmith shop, 45 by 38 feet, and those of the woodworking shops, 119 by 45 feet. All these departments will be equipped with the best machinery so that repairs can be made rapidly and economically. The paint shop and carpenter shop will be located in the cen-

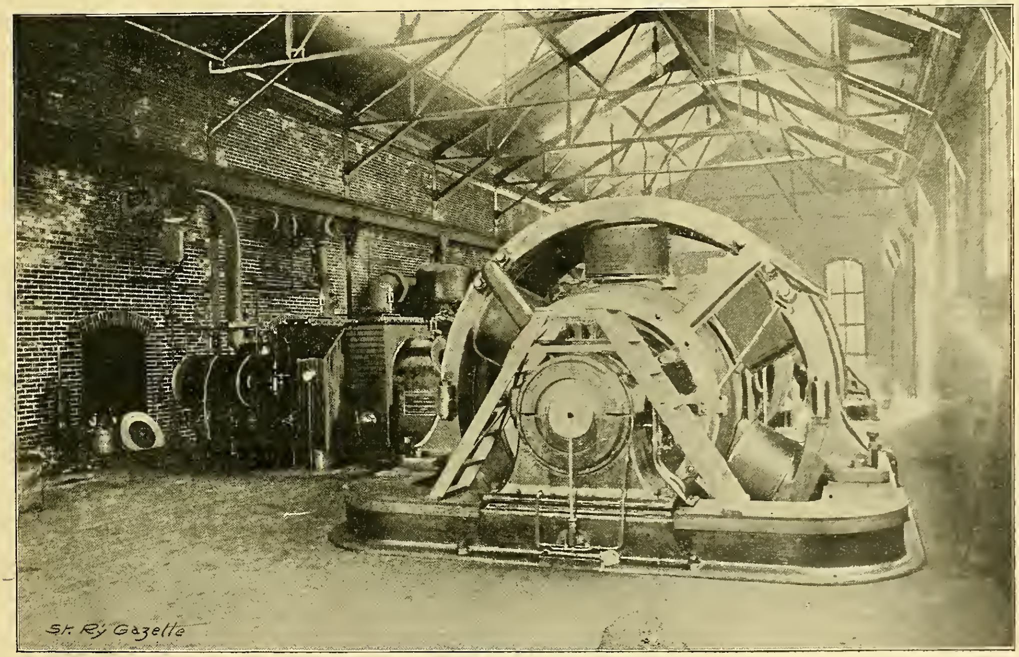


FIG. 1.—GENERATOR ROOM.

tral part of the building at the left of the main transfer tracks. The contractor for the building was Charles McCaul, of Philadelphia.

Baltimore Fenders.

Director Beitler, of the Philadelphia Department of Public Safety, recently deputed Harry B. McIntire, of the Electrical Bureau, of that city, to visit Baltimore and report on the fenders in use there. In his report Mr. McIntire writes: "In the year and a half preceding the passage of the law requiring fenders on street cars in Baltimore the deaths resulting from cars coming in collision with individuals numbered almost 100. Since fenders have been required the accidents have become so few that no one seems to have thought it interesting to keep an account of them, and I have been assured that every day people are caught up and carried in the fenders on some one of the lines. The editor of the Baltimore *Sun* told me that the *Sun* has published at least 40 accounts of such instances. Of the four designs of fenders used in Baltimore, only one was approved of by Mr. Cohen, engineer of the City Commission.

"Judging from the fenders I have seen and the experience I have gained I should say that a good fender consists of a front fender and a wheel guard. A good front fender means one that extends about three and one half feet in front of the car and rides about six inches above the track, high enough on the dashboard to protect against striking the bumper and drawbars. It will give a yielding blow in case it strikes any one, and if the body is prostrate on the ground it will ride over it without difficulty. The wheel guard should be automatic, not only dependent upon the rising of the front fender or upon the tripping of a gate, but also be under the control of the motorman, that he may drop it in case of necessity."

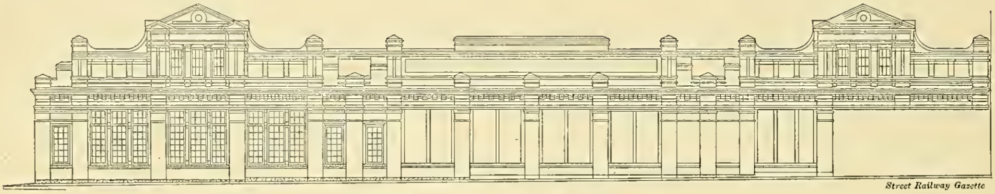


FIG. 2.—ELEVATION OF CAR HOUSE.

Taxes of Elevated Lines.

The Brooklyn Elevated Railway Company and the Kings County Elevated Railway Company, of Brooklyn, have petitioned the Board of Assessors to reduce the assessment on their structures from $170,000 to $100,000 per mile. The companies claim that the business of their roads has been reduced to such an extent by the competition of the surface electric lines that they are unable to pay the amount of taxes which has heretofore been collected of them.

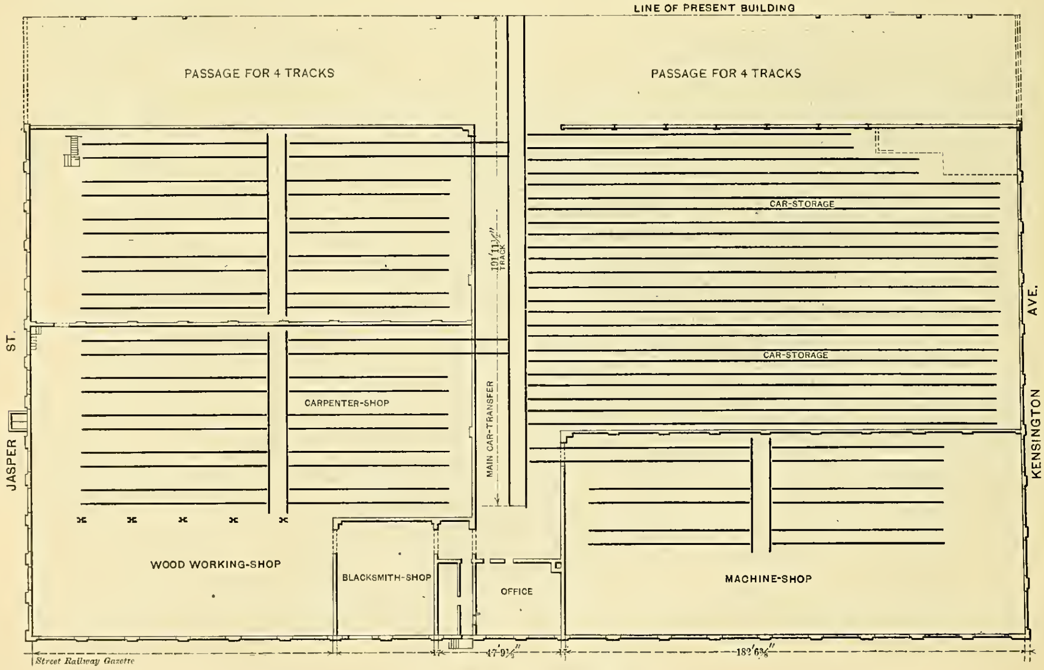


FIG. 3.—PLAN OF CAR HOUSE.

Some Practical Notes for Motormen.—VII.

BY GEORGE T. HANCHETT.

The second winding, which it is considered well to discuss, is a typical drum winding due to Siemens. Here the return circuit, which in the ring winding passes through the hole in the centre of the ring, is brought around on to the other side of the armature and becomes an effective driving conductor. This gain is compensated for by the additional dead wire necessary at the end of the cylinder. A development and view of the winding is shown in Fig. 18.

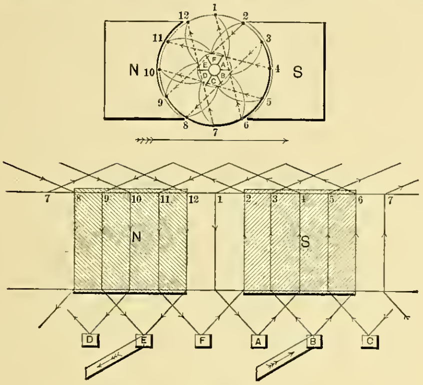


FIG. 18.

It is merely necessary to trace out the direction of the currents by the arrows, to see that the same thing is here accomplished as in the case of the ring armature. Fig. 19 shows a quadrupolar ring winding, and Fig. 20 a quadrupolar drum winding. Figs. 21 and 22 show quadrupolar ring and drum windings which should be studied with special care, as they are much used on railway motors.

A glance at these last two figures will show that but two brushes are used and on an angle of 90 degrees with each other. The advantage of this arrangement is very great in the case of a railway motor.

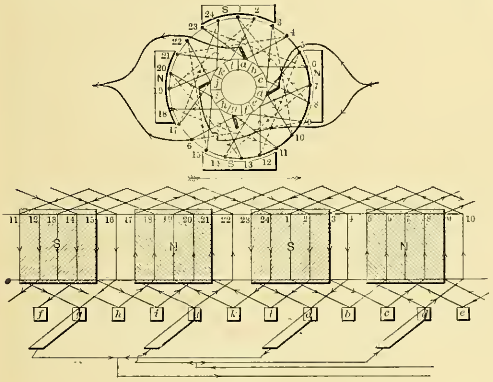


FIG. 20.

Of all organs of such a motor, the commutator and brushes are the most susceptible to disorder, and where they are not working properly, the motor as a whole is seriously affected. Therefore, this method of two brushes on the quarter is most convenient, as the motor may be arranged to have these brushes very convenient of access. Two widely different types are shown in Figs. 20 and 22. Of course it will be readily seen that the one is a ring and the other a drum, but there is another and more important difference. Almost any closed coil armature can be treated as in Fig 21. Inspection of this figure will show that the only difference between this and a simple ring winding is that the opposite segments are connected together. In the figure showing the simple-form pole-ring winding, the opposite segments are connected together by means of connecting the opposite brushes together. Of course in this case the opposite segments are connected together only for an instant, whereas in the other arrangement they are together all the time. However, when it is noticed that bobbins that are equal distances from + and — brushes are connected together, that is, similarly placed with regard to potentials, it will be seen that this cross-connected armature, as it is called, is not different from the simple ring-winding.

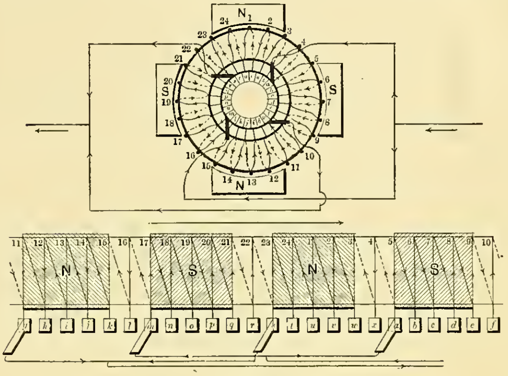


FIG. 19.

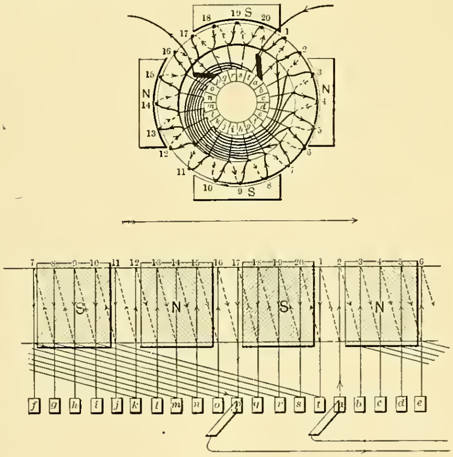


FIG. 21.

No current flows in the cross-connections until they are under the brushes, for the cross-connected bobbins are always at the same potential or pressure. When any segment is under the brush a current flows in the cross-connection, not from bobbin to bobbin, but from bobbin to outside circuit, as shown by the arrows in the figure. The wires connecting the two like brushes together is simply replaced by the cross-connections.

The winding shown in Fig. 22 is of a totally different type. The convenient arrangement of two brushes on the quarter is accomplished by winding the armature so, that the similar bobbins are placed in series instead of parallel. By tracing out the current in the winding of Fig. 22 it will be seen that there are two paths through the armature, instead of four as in Fig. 21. Other things being equal, this has the object of doubling the torque and halving the speed that would occur were the armature parallel wound. Slow speed and powerful torque are very desirable factors in railway work.

We have obtained an idea of the construction of a railway motor purely theoretical, it is true, but none the less valuable. Before going into the practical construction of motors, it is well to consider a few more points of theory, as regards operation.

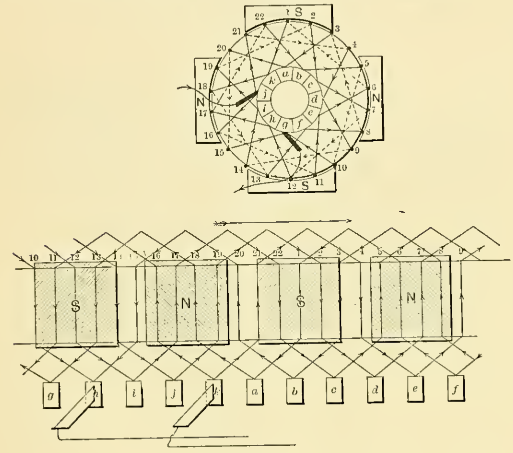


FIG. 22.

There are, as we have seen, two essential parts to a railway or indeed any electric motor, and both of these must be supplied with current before rotation of the armature is produced. How these two portions of the mechanism receive their current, next becomes important. At this stage it is not wise to consider the rather complex problem of two motors and controllers. The single motor will be sufficiently complex for the present.

The source of current on an electric railway car is simply through the trolley and track. From this source, field magnets, armatures, lamps, heaters, etc., must all be operated. We may connect the field magnets and armature to these two sources of current in various ways, and each of these methods produces a motor of very different properties. While we particularly desire a motor which shall have a powerful starting effort to overcome the friction of repose, we do not desire constant speed of rotation, in fact, it would be a decided disadvantage. We also want our motor especially rigged against electrical as well as mechanical abuse. These features are largely accomplished by the method of connecting.

(To be continued.)

To Use Dummies.

The Delaware County Passenger Railway Company, of Philadelphia, which has been enjoined from erecting poles and wires, proposes to operate the road by steam dummies temporarily.

Protest Against Electric Railway Mail Service.

The Street Railway Employees' Association, of New Orleans, has sent a curious letter to Postmaster-General Wilson, protesting against the use of street railway mail cars. The following extract covers the principal points of the letter: "The original plan, emanating from the department itself, contemplated two cars only as being amply sufficient for the needs of the situation. But the mere mention of the project at once suggested to our railway authorities the opportunity for an important amendment This was that, instead of having two special cars exclusively devoted to the mail, all the cars on all the roads should be held at the disposal of the department for that service at any moment that might appear opportune. It is supposed that the real motive of these corporations in proposing this change is to have all their cars recognized as United States mail cars, and, as such, under the protection of federal bayonets. This protection of federal power against strikes is a two-edged weapon. One edge is used, and very properly so, to cut short-off any strike that savors of violence and crime. The employees of our New Orleans car lines have announced plainly and openly that they do not approve of strikes conducted on that method. They are mostly young gentlemen, belonging to good families, and are by their antecedents and associations in sympathy with the law-abiding elements of our society. If their organization should find a strike necessary they will not hesitate to take that recourse, but only through methods strictly within the limits of the law. Therefore, they have no apprehension on that score; no fear of wrong from that edge of the federal sword. But there is another edge to it.

"In the hands of a skillful master of fence, that other edge may be very effectively turned against strikes which manifest no disposition to violence, but which, on the contrary, are organized, and are proceeding on the strictest lines of peace and quiet. It will be remembered that in the Pullman strike case criminality has been attributed to men in acts unconnected with violence and irrespective of violence. Merely combining together in a boycott and persuading others to join it is held to be an offence whenever it may affect interstate commerce, the mails, or any other government interests. Injunctions issue at once in such a case, and the chief must yield at once or go to jail. This is depriving strikers of the only instrumentality which they may peacefully use for the accomplishment of their purpose.

You first say to them, and very properly, you shall not forward your strike by intimidating men, or hurting them; you must prevent them by persuasion and other moral influences from taking your places. Then, when the strikers have agreed to this, you go farther; you say they shall not persuade others to aid their strike by methods equally peaceful with their own. It is perfectly clear that if labor organizations are prevented by law from taking any means whatever to make their strikes effectual they may as well disband. The strike is the only distinction between free labor and slave labor, and a strike foredoomed to failure is no strike at all. In such case the price of labor will be fixed by the employer at his own discretion. We hope that the government will pause before extending the arena of that jurisdiction, which can, by a single injunction, strike down the only barrier that labor can erect between itself and slavery."

The Substitution of Electricity for Steam in Railway Practice—II.*

BY DR. LOUIS DUNCAN.

The condition of affairs in electric transportation is at present curious. The trolley companies, by extending their lines, are working from tramway transportation to through transportation. They are attacking the problem by development from small motors to larger ones. The railway companies starting with the large units are coming down in the direction of the present trolley systems, as in the cases of the Nantasket Beach Road of the N. Y., N. H. & H. R. R. Company. Perhaps in the future they will meet and some standard electrical system will be adopted for the present steam road. I think then, that in the case taken up, the policy of the road will be to equip those branches for which the conditions are favorable with a trolley, run comparatively large motor cars capable of drawing one or two ordinary passenger or freight cars as trailers, using the present steam service for their freight traffic when necessary. This will allow the necessary through travel, will give the required local service between towns, and will not interfere with the freight traffic.

As for the systems to be used for such services, I believe that at the present moment the continuous-current overhead trolley system is the only one that can be selected with a certainty of successful operation. It gives a minimum complication in the way of conveying the current to the cars, it allows a considerable range of speed with a comparatively high efficiency, and our experience with it is such that successful operation could be at once guaranteed. By using different voltages in the towns and on the line, both high and low speeds can be obtained. If the line to be operated is to be very long it might be best to use rotary transformers by different sub-stations along it, the line being supplied by continuous currents from the sub-stations. In fact the three systems that are at present possible, are first, the ordinary direct-current system, second, a system in which direct currents are used on the line and rotary transformers supplied by alternating currents are placed along it, and third, a two or three-phase system supplying rotary field motors on the cars. In the latter case, it would be well to employ different periods in the towns and on the lines.

The second case which I wish to consider is that of roads built for an entirely new electrical equipment, such, for instance, as the elevated roads in Chicago, and the underground rapid transit road in New York, or the proposed Washington-Baltimore Boulevard line. In most of these cases the traffic is almost entirely a passenger traffic, and the conditions are especially favorable for the operation of electricity. Taking first the case of the New York underground road, there will probably be required about 150 trains for local service, each train having five ordinary cars and a motor car. For the express service there would be about 25 trains of, say, four ordinary cars with a motor car. For this it would probably be best to use the direct-current three-wire system, one of the cars on the train being equipped with motors and acting as a locomotive. With four motors on a car the system would be efficient at all practical speeds, and if desired, a large part of the energy could be thrown back on the line when the cars are being stopped. In the case of the local trains a simple calculation will show that a very small part of the total energy expended is used in overcoming the track resistance, while a very considerable part is employed in accelerating the train and afterward wasted by braking. I have calculated the amount of energy which can be practically saved under the conditions of local and express traffic on the New York underground, and find that with motors of ordinary efficiency about 45 per cent. can be returned. If storage batteries are used in connection with the central stations, the batteries being located along the line, a uniform load can be thrown on the stations, and their capacity may be reduced to almost one half as compared with a system in which the energy is not returned, thus greatly decreasing both the expense of installation and of operation. As it is possible at present to obtain batteries with a rapid discharge rate at very reasonable prices, and with a guarantee for repairs, that place them well within the limit of commercial calculations, a system of this kind offers some advantages over any other system that could be applied to the operation of the underground road. An alternating current would hardly be economical for this work, as it precludes the possibility of returning the energy to the line, and as the variable speed required makes it uneconomical as compared with the direct-current system, using, say, four motors with series-parallel control. In the case above cited, shunt motors would be used, and it would be possible to get a contact with the line that could not, under any circumstances, be broken. The case of the elevated roads is very similar to the one I have cited, except that in existing structures shorter trains would be used, and the cost of equipment for a given number of cars would be somewhat greater.

The Baltimore & Columbia Railway Company owns in Washington the Eckington & Soldiers' Home Railway, and the Belt Line railways, and has franchises for extensive additions to their present mileage. In Baltimore they are constructing a road in the city and beyond it to Ellicott City, and they have also purchased a steam line running from Baltimore to Catonsville. They have rights of way from the terminus of their Baltimore lines to the lines they own, and are preparing to build in the District of Columbia. The problem offered is not a simple one, but it is one of the most attractive that can be presented to electrical engineers. Speeds of 60 miles per hour are to be used for the cars outside of the city limits, and within the city limits ordinary speed is to be employed. In the District of Columbia overhead trolley is to be employed. In fact there is presented almost every problem which must be solved if electricity is to displace steam in the future with the same rapidity that it has done in the past. Many high-speed electric roads have been projected, but I think this road will be the first to solve the detailed problem of interurban rapid transit.

The last subject which I wish to take up is the electric plant for the Belt Line tunnel of the B. & O. Railway. In this case there is no question of economy in the employment of the electrical locomotives, as the plant adds considerably to the cost of operating the road. The Belt Line tunnel runs beneath the city of Baltimore for a distance of one and one quarter miles, then to the outskirts of the town through open cuts and short tunnels. There is a grade of .8 of one per cent. over almost the entire length of the tunnel proper, while one half mile beyond it there is a grade of 1½ per cent. Being in the middle of the town it would have been difficult to have provided a satisfactory ventilating plant, even supposing that ventilating plants had been successful in other localities, which is not the case. The managers of the B. & O. Railway Company wished to provide a satisfactory service, and considered a number of plans for drawing their trains through the tunnel without the annoyance due to smoke and gases. After careful consideration they concluded that electricity was the most satisfactory means to accomplish this. The General Electric Company was confident enough of the ability to successfully equip the road to make a contract with the B. & O. Company to haul its trains over the Belt Line, the contract being dependent upon the successful operation of the plant. The total length of the line equipped is about three miles, the extension beyond the tunnel being for the purpose of assisting the freight locomotives to haul their trains up the 1½ per cent. grade on the line beyond the tunnel. There are to be three locomotives, and it is calculated that the traffic can ordinarily be handled by two of them. The steam engines are not to be taken off the trains, but hauled through the tunnel by the electric locomotive which switches off at the terminus of the line. To operate these machines the station has been erected which contains 3,000 hp of electric generators, and an overhead line has been equipped to transmit current to the locomotives. With respect to the station itself there is little that is novel. There are four 750-hp Allis-Corliss engines directly coupled to generators of the same capacity, the generators having a voltage of 600 at no load, and 700 at full load. Foundations have been partly erected for a fifth unit in case it is found necessary. The building also contains the lighting plant, having a capacity for 400 arc lights and 4,000 16-cp incandescent lights. Provision has also been made for an extension to this lighting plant when the stations for the belt line are erected. There are two incandescent machines, and one of them will be used to supply the 1,000 32-cp lamps which have been installed in the tunnel. Perhaps the most novel feature of the plant is the overhead structure which is employed. The conditions to be met were peculiarly difficult, and the ordinary under-running trolley was considered impracticable. The tunnel is very low in places, and the management of the road decided that the conductors could not be placed over the cars, but should be placed in the middle of the tunnel between the tracks. Outside of the tunnel the conductor is still between the tracks, but is elevated to a height of 22 feet, while inside the tunnel it is only 17 feet from the top of the rail. The conductor consists of an iron trough made of two *Z* bars riveted to a cover plate 12 inches wide, leaving a slot one inch wide between the *Z* bars. In the tunnel this trough is supported from transverse channel bars secured to expansion bolts, which are fastened from the top of the tunnel. There is a double insulation; one porcelain insulator being between the channel bars, and another between the channel bars and the expansion bolt. Outside the tunnel the trough is supported as follows: At distances of 150 feet light iron columns with cross trusses are erected, and between these trusses are hung catenaries supplied with a number of suspension bolts. Transverse channels similar to those used in the tunnel are fastened to these bolts, and the trough is fastened to the channels. The *Z* bars are made in lengths of 30 feet, the opposite bars breaking the joints with one another, the lengths being riveted together and then bounded with "Chicago" rail bonds. Suspended on the same transverse beams as the trough are three copper cables of 1,000,000 circular mils area, which serve as feed wires which are connected at intervals with a trough, there being, of course, one trough for each track. For the return circuit the tracks are bonded as in ordinary railway work, there being cross-bars and at intervals connections with a copper cable of 1,000,000,000 circular mils area varied in a wooden trough between the tracks. The contact arrangement that is to be used consists of a brass shoe traveling in the trough and connected with a locomotive with a flexible sawbuck arrangement which has a very considerable range in every direction. The current is transmitted to the motors by a copper cable, and in case of the shoe sticking in the trough, a safety pin is arranged to break with any desired strain. Where switches are used there is a tongue worked by a lever which operates the track switch, and which serves to direct the shoe. This structure, although exceedingly massive and expensive, promises to give an excellent contact at all times, and it requires no care from the motorman.

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* Inaugural Address delivered at the Niagara Falls meeting of the American Institute of Electrical Engineers, June 25, 1895.

The locomotives are the most massive in the history of either steam or electrical transportation, and the weight, which amounts to 95 tons, is on eight driving wheels, so that the full tractive power of the locomotive will be developed. On each axle there is sleeved a six-pole motor, there being considerable play between the axle and the sleeve, which latter is spring-supported from the frame. In this way any heavy blow due to irregularity in the track is taken through the springs, and the wear both of the track and locomotive is reduced. On the armature shaft are projecting arms which move between lugs cast on the wheels, thus allowing the necessary relative motion between the axle and armature. The station is completed, and is being operated daily. One of the locomotives is on the ground, ready to run, and the overhead work is finished.

If this equipment proves successful it will open a limited but important field for the introduction of large electric locomotives. There are in the United States a number of tunnels whose operation is anything but satisfactory at present, which can be equipped as the Baltimore tunnel is equipped. Several of them have the additional advantage that they are near the switching yards of the roads, and the same plant could be used for hauling trains through the tunnels and for switching, and not only would the economy of the station be increased, but the substitution of electric for steam switching engines would result in a very considerable saving.

This is the last of the subjects that I proposed to consider. In this paper I have not indulged in prophesy, nor have I imagined any apparatus or equipment which cannot be bought in the open market. But to me it seems that the present is a crisis in the history of railroading. Up to the present the steam roads have ignored the competition of the electric roads or they have fought them. To-day they cannot afford to do either.

In a few years electric roads will have absorbed practically all of the local traffic, and will begin to cut into through transportation. The steam roads cannot afford this; their only safety is to make electricity an ally instead of an enemy, and this before it is too late.

The conclusions that I finally reach are these:

1st. The tendency of passenger transportation on the steam lines has been in the direction of the greatest electrical economy, while the tendency of the freight transportation has been in the direction of the least electrical economy.

2d. It will not pay any through line with considerable traffic, having two tracks, to equip their main tracks electrically.

3d. With four-track roads it will pay to equip all of the tracks electrically, unless a considerable portion of the business is through passenger traffic.

4th. It will pay all the larger roads either to equip a number of their branch lines electrically, or to control competing electric lines.

5th. In order to remain on a dividend-paying basis it is imperative that most of the two-track lines either build additional tracks or control the electric roads that parallel them.

6th. Believing that ultimately all of the traffic will be done by electricity, it is imperative that the managers of steam roads keep constantly in touch with electrical progress.

Speed Question in Brooklyn.

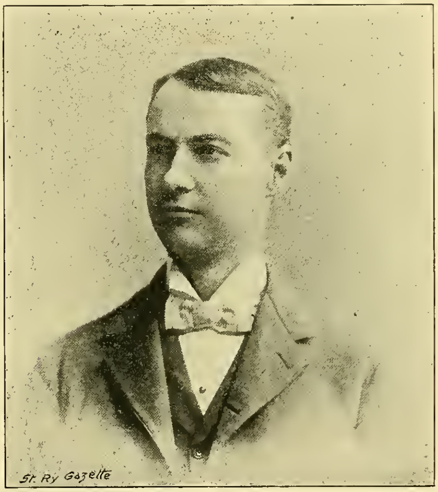
The Brooklyn electric railway companies against which actions were recently instituted for the recovery of fines for the alleged violations of the city ordinance regulating car speeds made answer this week. The ground on which the several companies base their defense is practically the same. The ordinance limits the speed of cars to six and eight miles an hour. The companies hold that in the resolutions of the Common Council permitting the change of motive power to electricity, provision was made by which the cars might be operated in such manner as to best accommodate the public, the speed in no case to exceed ten miles an hour. At great expense the companies, accepting the grant, made the change of power. The companies maintained that the Common Council had no right, power or authority to make the ordinance limiting the speed to six and eight miles, as it is in violation of the franchise grant.

Philadelphia Electric Railway Mail Service.

Postmaster Carr has made a report of the electric railway mail service in Philadelphia for the month of June. The report shows that the arrivals and departures on the trolleys were, according to the schedule, practically on time, with two exceptions. There were 500 connections made at 10 different points. In the opinion of the postmaster this report is a satisfactory one.

Street Railway Engineers.—XI.

F. O. RUSLING.



F. O. RUSLING.

Mr. F. O. Rusling, the general superintendent of the Buffalo Railway Company, of Buffalo, N. Y., has been connected with electrical interests since 1882. He was born in New Brunswick, N. J., in 1863, but two years later the family moved to Lawrenceville in the same State. When he was 17 years of age Mr. Rusling went to Saginaw, Mich., and was associated there with his uncle in the electric lighting business. After a year's service he was made superintendent of the station. After three years spent in Saginaw and Bay City, where a plant also had been built by his uncle, Mr. Rusling accepted a position as dynamo expert for the Brush Electric Company, with headquarters in Chicago, where the local agent was the Bullock Manufacturing Company. He was employed in this capacity two years, and then accepted the position of assistant superintendent of construction of the Schuyler Electric Company, of Hartford, Conn. After he had been in its employ for a year and a half he was sent by the company to Wichita, Kan., to manage and develop an electric light station which it owned in that city. He made an admirable record there in putting the business on a solid basis, and in materially increasing the demand for lights. He was in Wichita two and one half years, during which time an electric railway was installed. In the installation of the line his knowledge as an electrical expert was not infrequently appealed to, and becoming interested in the electric railway field he accepted the superintendency of the electric light and railway system in St. Joseph, Mo. Private considerations made it necessary for him to return to the East, and he held the position for one year only. Subsequently he was appointed general superintendent of the West Bay City (Mich.) Electric Street Railway Company, and remained in this capacity for a year and a half. Mr. Rusling then went South, and for three months was engaged in improving the plant of the Austin Rapid Transit Company, of Austin, Tex., after which he was appointed general superintendent of the Calumet Electric Street Railway Company, of Chicago. While connected with this company he made an excellent record both in handling the men and in developing the property. After a year and a half he was appointed to the position of general superintendent of the Buffalo Railway Company, which he now holds. He has been highly successful in operating and improving the splendid plant of the company. Mr. Rusling is eminently a practical man, and to this fact much of his success in the electric railway field may be attributed. He has had marked success in dealing with employees, and in introducing features which have resulted in the decrease of operating expenses.

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INVESTIGATING STREET RAILWAYS.

A perusal of the reports of the sessions of the legislative committee appointed to investigate New York street railways is not calculated to cause one to characterize as libelous the charge that the main purpose of the Assembly in creating the committee was to afford the members an opportunity to enjoy a pleasant junket at the expense of the State. The committee has this week been sitting in Brooklyn and has heard from a variety of witnesses the story of the development of the local surface railway systems and of the companies which control them. The committee has elicited the fact that the promoters of the several enterprises were influenced, when investing their money, solely by a desire to make money. This truth has been strongly suspected heretofore and its discovery cannot be considered as original with the committee. The commission will have to change its tactics if any significance is to attach to its investigation.

PATENT ON OVERHEAD SWITCHES SUSTAINED.

In a recent important patent decision Judge Coxe, of the United States Circuit Court, pays a well-deserved tribute to Charles J. Van Depoele, whose splendid work in the pioneer days of electric railway development is not always appreciated at its proper value in these days of rapid progress. "Although the electric road of to-day is a composite organism," says Judge Coxe, "to which many ingenious and able men have contributed, yet it cannot be denied that to Van Depoele more than to any other man belongs the credit of having made it a practical working success. His contributions to the art rapidly supplanted the crude and tentative prior structures and have continued in use until the present time." The sentences quoted appear in the opinion accompanying the decision in a suit brought to recover for the alleged infringement of a patent for overhead switches issued to Mr. Van Depoele. The action was instituted by the Thomson-Houston Electric Company against the Elmira & Horseheads Railway Company, and it appears that no little significance attaches to the decision as in general it sustains the validity of the patent, and finds that types of overhead switches complained of are infringements. The most interesting claim made by the defense was to the effect that Van Depoele's patent did not cover an invention, as the patentee had, it was claimed, merely suspended, face downward, the well-known form of railway switch. To this the court says that when it is taken into consideration that "he was dealing with an underrunning system, that it is necessary to shift the trolley not only, but the mysterious current which the trolley carries, and that he accomplished this result automatically when others failed, it is not difficult to place him above the plane of the mechanic." The finding of the court may not be satisfactory to all electric railway companies if the complainant proposes to push its advantage, but no inventor will be likely to quarrel with the position assumed throughout the opinion by Judge Coxe. It recognizes in a remarkably appreciative way the skill, ability and rights of those who devote themselves to the productions of new and improved devices.

ELECTRIC LOCOMOTIVES.

The application of electricity to the operation of the tunnel line in Baltimore affords another striking example of the use of the electric motor instead of the steam locomotive in railway practice. From every point of view the installation is an interesting one, and it is deserving of the very considerable space which we devote elsewhere in this issue to the description and illustration of its characteristic features. The determination to operate the Belt Line by electricity was primarily due to the desire on the part of the projectors to avoid the necessity of providing a comprehensive plan of ventilating the tunnel. With electric locomotives no solution of the problem was needed. At the same time it is confidently expected that other advantages will be derived from the adoption of the electrical system of operation. Time will be saved in the moving of trains and it is believed that a substantial economy in working expenses will be effected. The greatest interest in the installation attaches naturally to the locomotives, which are the most powerful and ponderous machines ever constructed for purposes of railway traction. Not a few interesting stories illustrating their capacity are related. In the tugs-of-war at the factory when they were pitted against steam locomotives they made play-things of the latter, according to the reports which, beyond a doubt, are substantially correct. When one of them was tried a few days ago in the tunnel the trolley was welded by the current fast to the conductor. It had to be temporarily abandoned and two steam locomotives were required to perform the work which it had been doing. This incident should not be taken, however, as reflecting in any way upon the character of the construction. It has no significance whatever beyond illustrating the formidable work which the locomotives are designed to perform. Incidents similar to this are naturally to be expected until trivial defects in the experimental features of the installation are eliminated and the system is in smooth working order. The demand for electric locomotives of a weight equal to that of those in use on the Baltimore tunnel, which is considerably in excess of the heaviest steam locomotives, will necessarily be limited. Railway men are looking for rolling stock not heavier but lighter, and therefore less destructive to track construction than that at present in service. In a number of places, however, conditions similar to those encountered in Baltimore will make the adoption of similar locomotives desirable and profitable. Such machines, however, will have no place in general railway work. Electrical progress in that direction is more likely to proceed along the lines of the Nantasket Beach Railway installation, which was illustrated and described somewhat at length in the last issue of the ELECTRIC RAILWAY GAZETTE. That road seems to be an almost ideal branch line, and its success is bound to lead to the multiplication of such railways. Even at the present time the officials of the New York, New Haven & Hartford Company are practically admitting that other lines in their system will be similarly equipped, for in one statement they refer somewhat enthusiastically to the satisfactory results attending the operation of the Nantasket Beach Railway, and in the next are quoted as saying if its success is demonstrated similar lines will be operated by electricity. Truly the present is an interesting time in the field of electric traction, and new developments, no less significant than those which have been chronicled of late, may be confidently expected within the next few months.

Boston Rapid Transit Subway.

Satisfactory progress has been made of late on the Boston subway which is to be used by electric cars in the business district of the city. The structural steel which the Pennsylvania Iron Company is rolling has arrived in sufficient quantity of late so that there is no danger of delay through lack of material. That the drainage system of the subway is substantially perfect has been demonstrated within the last few days. No trouble was experienced during the unusually heavy fall of rain. There remain only two more sections of the invert to be put down, when the concreting of the Public Garden section will be completed. In its present stage it does not present a finished appearance owing to the irregularity of the flooring at the edges. When the filling for the roadbed is in place, however, these deformities will be concealed.

The contractors are making rapid progress toward the Charles Street line from the Common side, as it is their desire to finish the excavation at this point as soon as possible. When completed the tunnel will be carried across the street, the work of connecting the sections being comparatively easy.

The grading of the Public Garden on the north side of the retaining walls is nearly completed, which gives a finishing touch to the massive walls.

Northwestern Electrical Association.

The summer meeting of the Northwestern Electrical Association will be held at the Leland Hotel, Chicago, July 17, 18 and 19. An interesting programme has been arranged. Among the papers will be one on "Boiler Feed Waters: Their Treatment," by W. D. Jameson and one on "Boilers and Practical Specifications for Building Them," by J. C. McMynn.

Bonds for Employees.

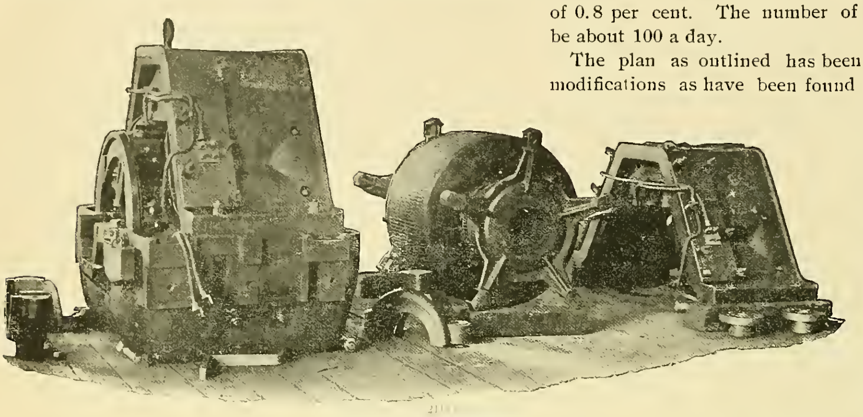
The Brooklyn Elevated Railway Company has decided that all of its employees who handle money shall furnish bonds. The company will pay the premiums. The amounts of the bonds will vary in accordance with the responsibility of the positions, but that of the ticket agents will be $300. All the large railway companies of Brooklyn, with a single exception, are now protected in this way.

Right to Operate Omnibus Line Questioned.

Counsel for the Philadelphia Traction Company have filed a petition with the attorney general at Harrisburg, Pa., for a writ of quo warranto compelling the Omnibus Company General, of Philadelphia, to show by what right it operates a line of omnibuses on Broad Street in that city.

Electric Locomotives in the Baltimore Belt Line Tunnel.

Prior to the construction of the Baltimore Belt Line tunnel all trains on the Baltimore & Ohio running between Baltimore and the north were compelled to follow a devious course and were transferred by ferry between Locust Point and Canton. The delay attendant upon the route was so great that the railway company determined to build the tunnel to form a clear all-rail route through the city. Work was begun in September, 1890, upon the tunnel and line, which now runs from Camden Station, in the heart of Baltimore, north, and then east to Bay View Junction, a distance of 7.2 miles. The tunnel is one of the longest soft earth tunnels ever driven, and runs through the centre of the city, immediately under Howard Street, one of Baltimore's principal thoroughfares. Its length is 7,339 feet, and the maximum dimensions, after lining, are 27 feet wide by 22 feet high. Its cost, ready for the track, is set down at $225 a lineal foot.



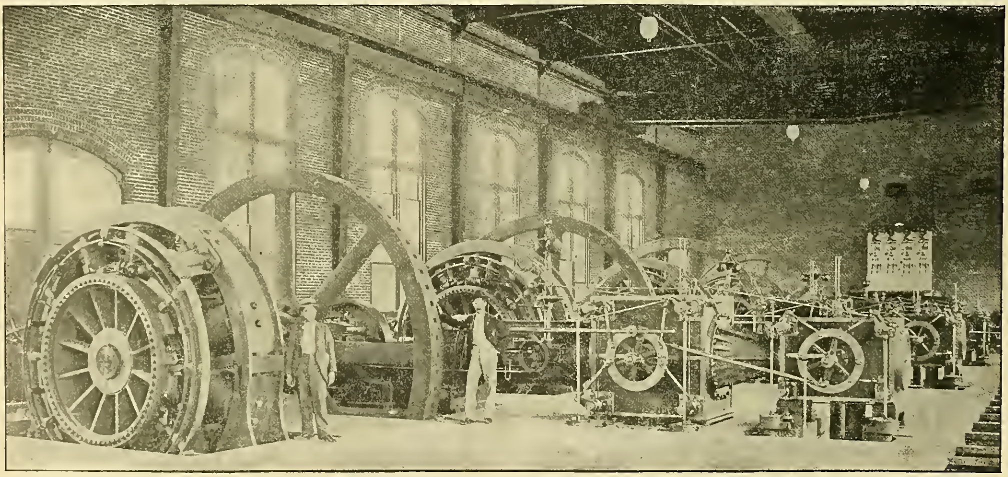
MOTOR UNASSEMBLED.

It was decided to adopt electricity, and the General Electric Company was given the contract for electric locomotives of a capacity sufficient to move the heaviest trains and for the power house equipment. The locomotives were to operate from Henrietta Street, about 1,800 feet in the open, to the portal of the tunnel at Camden Street, and thence to the farther end at Mt. Royal Avenue, and for 4,600 feet farther on in the open, or a total distance of about 14,500 feet. The locomotives were to join the rear end of passenger trains going north, at Henrietta Street, and push both cars and locomotives through to the second station, from which point the steam locomotive was to do all the hauling. Freight trains were to be pushed the entire distance. The calculations were to be based on a maximum weight of 500 tons for each passenger train, including the steam locomotives, with a speed of 35 miles an hour, and on a maximum weight of freight trains of 1,200 tons at speed of about 15 miles an hour, on a grade of 0.8 per cent. The number of trains each way was to be about 100 a day.

The plan as outlined has been carried out with such modifications as have been found necessary as the work progressed. Preparations were made to commence the work of construction on the locomotives, so that they should be ready at the time the tunnel was opened, which event was set for March, 1893. The tunnel was, however, not finished until early this year, and the electrical installation was not begun until January, 1895.

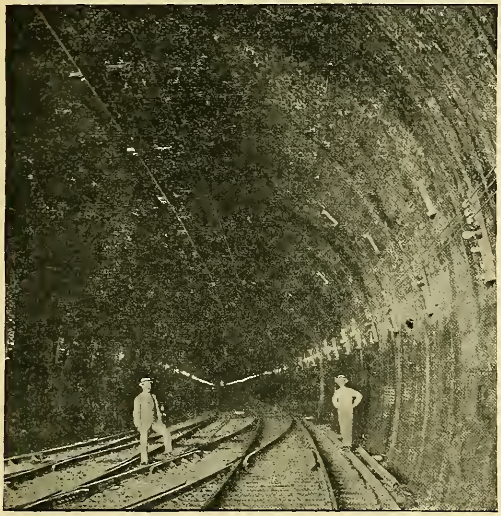
The power house, the dimensions of which are 332 by 223 feet, stands upon the west side of Howard Street, east of the tracks leading to the southern portal, and between Henrietta and Montgomery streets, two blocks south of the Camden station of the Baltimore & Ohio Railway. It is a one-story building rising 30 feet from floor to eaves, with walls of brick 1 foot 5 inches thick. It is divided into two parts, the engine room occupying the north portion, being separated from the boiler room by a brick wall.

The boiler house is a spacious and lofty room, containing 12 Root boilers (250 hp) arranged in six batteries, three of



ENGINE AND GENERATOR ROOM.

which are placed on each side of the centre passage. A system of mechanical draft is employed, and the flues run over the rear of the boilers and taper from 2 feet 9 inches square at the end to 5 feet square at the junction with the fan chamber, 9 feet in diameter, in which two fans of the Sturtevant pressure pattern revolve at 240 revolutions per minute.



INTERIOR OF TUNNEL.

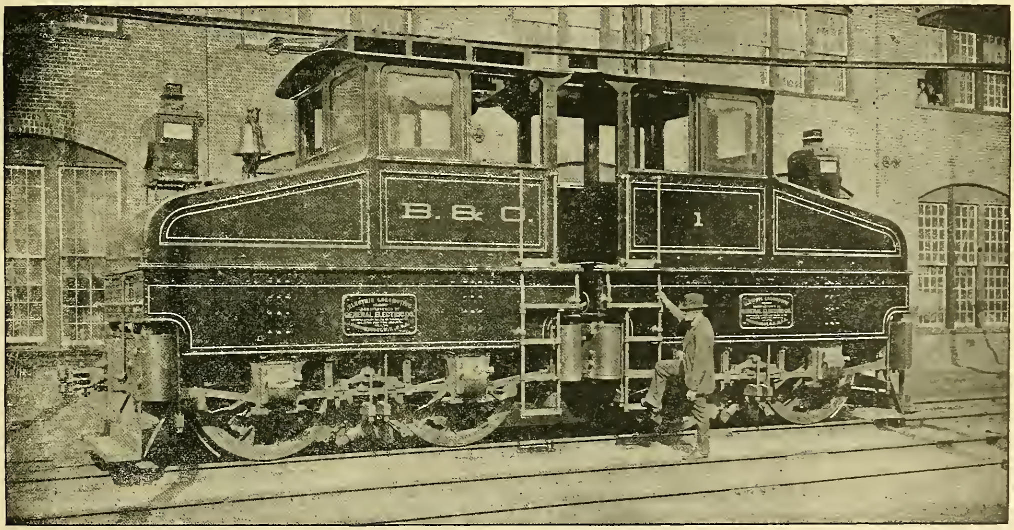
The boiler room is equipped with a C. W. Hunt coal crusher and conveyor, which brings the coal to the boiler and carries away the ashes from the ash pits, with Deane duplex feed-water pumps, and a 3,000-hp Webster feed-water heater. The steam system is in duplicate throughout.

The engine room is divided into two sections, one devoted to the power generators, the other occupied by the lighting dynamos. In the power section space has been provided for five direct-connected engines and generators, and four are now in place. The engines are horizontal, tandem-compound Reynolds-Corliss machines, from the shops of E. P. Allis & Company, and have 24 and 40 by 42 inch cylinders. Directly coupled to the engines are 500-kw General Electric multipolar generators, adapted to run with the engine at 110 revolutions per minute and wound for 700 volts.

The switchboard is of white marble and consists of four standard "K" generator panels, each equipped with all the necessary instruments for controlling and measuring the current from one generator.

The northern section of the engine room contains the lighting plant, consisting of eight 50-light Thomson-Houston arc generators, and two alternators for the incandescent lamp service in the tunnel. The arc light machines are belted to two cross-compound Armington & Sims 250-hp engines. Two other engines, of similar make and capacity, drive the two alternators, and space has been left for an additional engine and alternator. Each alternating generator has a capacity of 2,000 16-cp lamps, and as the tunnel is lighted by 1,000 32-cp lamps, one alternator will suffice for the present illumination of the tunnel. The arc lamps used in the illumination of the power house are of the Thomson 1893 type. In addition, it is lighted by clusters of three incandescent lamps each, fixed to the walls. The approaches and stations are lighted by Thomson-Houston standard arc lamps.

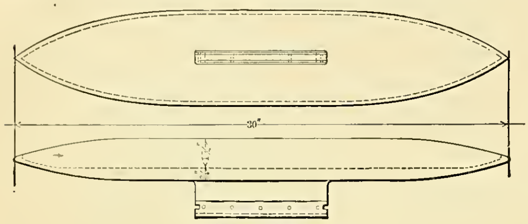
From the positive bus on the railway switchboard, eight cables of a total cross-section of 4,000,000 circ. mils, pass to the overhead structure immediately outside the power house, where connection is made to three feeder cables, of 1,000,000 circ. mils cross-section each, and to the overhead conductor itself, which has an equivalent of 1,000,000 circ. mils cross-section. The negative bus is similarly connected to the rails, which are double bonded with No. 0000 wire, and also to the return cables laid in a wooden box between the tracks. Contact between bonds and web is obtained by using a hollow rivet on each end of each bond and expanding it, when inserted in the rail, by means of a conical steel pin.



SIDE VIEW OF ELECTRIC LOCOMOTIVE.

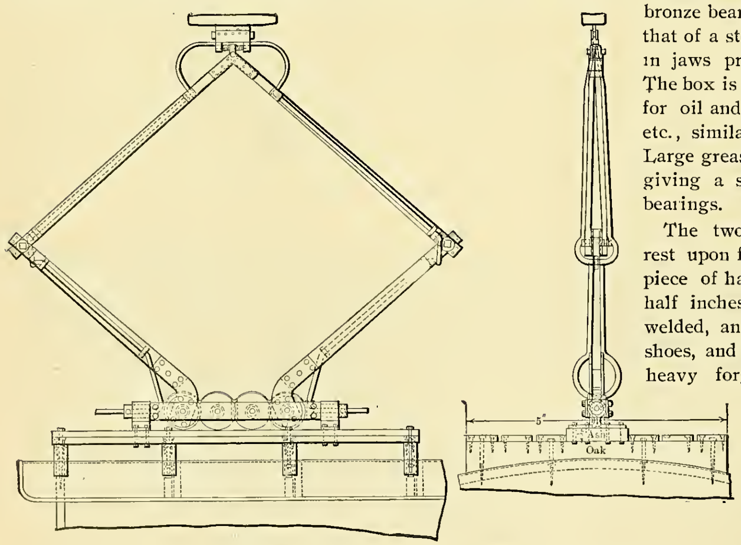
The distance over which the electrical locomotives will operate is about 15,000 feet, passing through two tunnels, 7,339 feet and 265 feet long, respectively, and over 7,396 feet of track in the open from Hamburg Street to Huntington Avenue.

Three tracks are laid into the southern portal, two tracks passing through the tunnel, four tracks from the northern portal, through the Mt. Royal Avenue arch, and two tracks as far as Huntington Avenue, where a siding is provided for the electrical locomotives. There is a steady grade of 0.8 per cent. from the southern through to the northern portal, and the lines in the open have two equated curves of 10 degrees, with a steady gradient of 1½ per cent. At the power house end of the line the locomotives run on a siding at the beginning of the long open cut running down to the southern portal.



TROLLEY SHOE.

The operation of the freight trains will begin at the main tracks south of the Camden station, where they will be switched into the cut. The electric locomotive will then couple on behind, without stopping the train, and push it through as far as the Mt. Royal Avenue portal, a distance of 8,146 feet, the steam locomotive doing no work. After passing out of the tunnel, both steam and electric locomotives pull and push together up the heavier grade as far as Huntington Avenue, the average speed over the entire distance being about 15 miles an hour. At Huntington Avenue the electric locomotive will uncouple and run into its siding.



TROLLEY—SIDE AND END VIEWS.

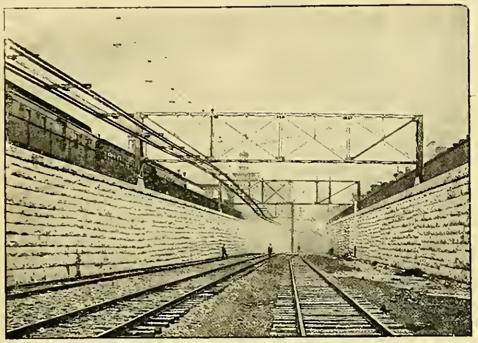
The plan of pushing the passenger trains through the tunnels has been abandoned, in view of the possible results if one of the cars or the steam locomotive should leave the track, in front of the heavy electric locomotive traveling at 30 miles an hour. The passenger trains will, therefore, be pulled through from the Lombard Street station near the south end of the tunnel to the Bolton Street station at the north end.

The most interesting portion of the installation is, of course, the 96-ton electric locomotives. The following data, relating to the machines, are given by the General Electric Company: Number of trucks, 2; number of motors, 4 (2 to each truck); weight on driving wheels, 192,000 pounds (96 tons); number of driving wheels, 8; drawbar pull, 42,000 pounds; starting drawbar pull, 60,000 pounds; gauge, 4 feet 8½ inches; diameter of drivers, 62 inches outside of tires; length over all, 35 feet; height to top of cab, 14 feet 3 inches; wheel base of each truck, 6 feet 10 inches; extreme width, 9 feet 6¼ inches; diameter of sleeve bearings, 13 inches.

The driving gear consists of a cast-steel spider shrunk on and keyed to a cast-steel driving sleeve, having a tensile strength of not less than 80,000 pounds. Each arm of the spider is provided with a double rubber cushion, with a chilled cast-iron wearing cap, the cushion being forced into the arms of the spider and the cap. The eight driving wheels are of cast steel pressed and keyed to the axles, and have tires, three inches thick at centres of tread shrunk on to the wheel centres. The driving axles are of special open hearth steel. The journal bearings are outside the driving wheels and allow of easy access to all parts of the truck frame and driving box. It is of cast iron with a phosphor bronze bearing fitted on in a similar manner to that of a steam locomotive driving box. It slides in jaws protected by shoes in the same way. The box is closed at the bottom and has a well for oil and waste, as well as a dust guard lid, etc., similar to an improved passenger car box. Large grease cups are cast in the journal caps, giving a satisfactory lubrication to the motor bearings.

The two opposite side frames of each truck rest upon four wheels, each consisting of one piece of hammered wrought iron, three and one half inches thick, to which the frame jaws are welded, and protected from wear by cast-iron shoes, and are connected together at the ends by heavy forged iron plates, with oak bumper beams between them. The drawheads are of Janney type, similar to those used on the Baltimore & Ohio passenger locomotive tenders, and are made of cast steel with wrought-iron knuckles. In coupling with freight trains the ordinary link and pin will suffice; but for passenger service the Janney couplers, with which each locomotive is provided, are used. The front and back of the locomotive is provided with safety chains, and in addition to the regular couplings, between the trucks, safety links are used. The buffers between the motors act as spacers for, and fit between plane surfaces in, the field magnets. These spacers have a complete freedom of movement which allows the field magnets to rotate when the motor is in action. These buffers and spacers are so placed as to permit the interchange and reversal of the positions of the field magnet without requiring change in the position of the spacers.

The motors are supported on carriers bolted to the field magnets, and rest in adjustable hangers carried on half elliptical springs placed on top of the frame and bumpers. The frames thus carry the motors by carriers and springs, and this load is carried in turn by rubber blocks in a cast-iron casing.



TUNNEL ENTRANCE.

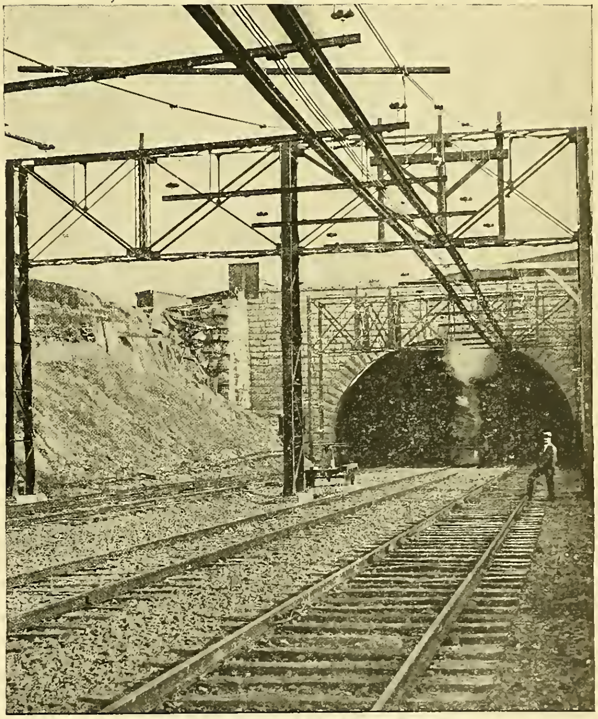
The locomotive is fitted with sand boxes, and Westinghouse automatic driver and train brakes are provided for all wheels, bearing upon the flanges and outside tread only. A brass signal gong, eight inches in diameter, is placed in the cab to be rung from either end of the locomotive. The headlights, of which there are two, are placed on the top of the shields at each end, and are 23-inch lights of Baltimore & Ohio standard pattern. One shield also carries a Baltimore & Ohio standard whistle, blown by compressed air. The other shield carries a standard bell, operated by an automatic air-pressure bell ringer. The locomotive is painted with the standard color and design of the Baltimore & Ohio Company.

The gearless motors are four in number, two to each truck, flexibly supported and transmitting the air power to the wheels through the flexible connections already described. They are of pyramidal shape, are the largest railway motors in the world, and while ponderous in appearance, are by no means so bulky as might be expected from the heavy work they have to perform.

Each has six poles and six sets of carbon brushes, the brushes being connected to a yoke revolving through 360 degrees to facilitate accessibility to them. It is possible to remove four brushes without disabling the motor. The field spools are encased in sheet-iron cases and fitted over the pole-pieces bolted to the field frame. The armatures are built of sheet iron laminations, and are series drum wound. They are known as ironclad, each insulated winding being embedded in an insulated slot cut into the outer surface of the armature body, and held therein by a wooden key. This armature, with the commutator, is mounted upon and keyed to the hollow sleeve which is carried on the journals on the truck frame. The in side diameter of the sleeve is about two and a half inches larger than the axle. The entire motor is practically fireproof.

When normally placed the motor rests in a position concentric to the axle, the clearance between the axle and the sleeve allowing of a flexible support. The interposition of the rubber cushions, through which the torque of the armature is transmitted to the driving wheels, allows the armature to run eccentric to the axle, when the motor departs from its normal position on account of any unevenness in the track. The motor is designed to allow of ready removal of the field frame for inspection or repair.

A test of the first completed truck, representing one half of the locomotive, was made upon the tracks at the Schenectady shops of the General Electric Company. In order to obtain the necessary load, a heavy six-wheel engine was made use of and the electric locomotive truck coupled to it. The machines were then sent in opposite directions and tugged at the connecting coupling as in a tug of war. The electric locomotive had a slight advantage over the steam engine in weight on the driving wheels, and pulled it up and down the track with apparent ease. For the same weight upon the drivers it was shown that the electric locomotive starts a greater load than the steam locomotive. The pull being constant throughout the entire revolution of the wheel, the difficulty of variation of pull with the angle crank, as in the steam locomotive, is eliminated. The test also proved that not only are the motors sufficiently powerful, but that the driving mechanism and armature couplings are amply strong to transmit the torque of the armature to the axle. Each motor is rated at 360 hp and takes a normal current of 900 amperes.



OVERHEAD CONSTRUCTION IN THE CUT.

The controlling devices and measuring instruments, etc., occupy the interior of the cab. The controller is erected in one half of the cab, and is of the series-parallel type.

The reversing lever projects through the upper plate of the controller cover. The resistances are placed around the frame beneath the floor of the cab.

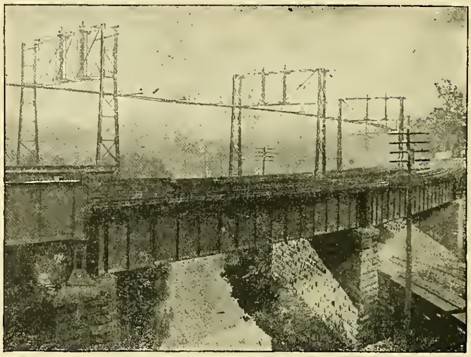
The locomotive is equipped with a 1,200 to 3,500 automatic circuit-breaker and one 2,000-ampere magnetic cutout, a 5,000-ampere illuminated dial Weston ammeter and one illuminated dial Weston voltmeter. The compressed air for the whistle and brakes is supplied by an oscillating cylinder electric air-pump, the air tanks being placed at each end of the complete locomotive. The interior of the cab is illuminated by clusters of incandescent lights.

Contact with the overhead conductor is effected by means of a sliding shuttle-like shoe of brass, which is fixed to a flexible support fastened to the top of the cab. This ''trolley'' support is diamond-shaped and compressible, contracting and expanding as the height demands, and is arranged to lean on one side or the other as the locomotive runs on one side or the other of the overhead conductor. It is, however, rigid in so far as movement forward or backward over the locomotive is concerned. The current is brought to the locomotive by means of cables connected to the shoe and fastened to the ''trolley'' support.

The conductor is simply a reversed iron conduit or trough erected overhead on trusses in the open and in the tunnel attached to the crown of the arch. In the open the conductor is directly over the centre of the track; in the tunnel over the centre line of the space between the tracks. It extends from Henrietta Street on the south to Huntington Avenue on the north, a distance of 15,000 feet.

The conductor consists of two three-inch iron Z bars ⅜ inch thick, riveted to a cover plate ¼ inch thick and 11½ inches wide, and is constructed in sections 30 feet long. It weighs about 30 pounds per foot. At intervals of 15 feet inside the tunnel there are suspended from the arch transverse frames, consisting of two three-inch channels, held together by plates 4 inches wide, and holding four castings into which are fitted conical porcelain insulators. In the masonry of the tunnel are fitted the bolts necessary to support these frames. They are 2 feet 6 inches long, have split ends, and extend 12 inches into the masonry. The bolts pass downward through the outside pair of insulators. The bolts attaching the conductors to the channel frames pass through the inside pair of insulators and support an iron stirrup in which the conductor hangs. This method affords a double insulation, and if leakage occur it can only be by the current passing the insulators between the conductor and the transverse channel, and then the insulation between the channel and the bolt in the tunnel arch. There may be a defective insulator either on the roof bolt or on the bolt which supports the conductor, but only when two insulators on the same transverse channel frame are defective will leakage occur. The height of the conductors above the level of the top of the rails is 17 feet 6 inches in the tunnel, and they are fixed a little on each side of the centre line. This plan was adopted to avoid the risk of the conductors striking brakemen who might be standing on the top of passing freight cars. An additional precaution is provided in the shape of continuous wooden shields fastened to the iron stirrup which supports the conductors.

Outside the tunnel the height of the conductors above the rails is increased to 22 feet. The supporting structure in the open consists of longitudinal catenaries of two chains of iron rods, having a span of 150 feet suspended from transverse trusses, supported by columns of latticed steel channels erected on either side of the double track. The catenaries pass over the top chord of the transverse trusses and are fastened to a yellow pine timber post, acting as an insulation set therein. From the joints in the catenaries vertical rods are dropped at intervals of 15 feet to support the electrical conductors. The vertical rods are attached to a casting holding a porcelain insulator, and through this a short bolt passes up to the joint in the catenary. The double insulation is secured by this vitrified porcelain insulator and the timber post, passing vertically through the transverse girder. A hood of galvanized iron is fixed to the top of the timber post. At the ends of the line an anchor pier receives the ends of the conductors. The trusses vary in length from 30 feet to 62 feet, the latter being required to span five tracks. All the iron work was made by the Maryland Steel Company.



OVERHEAD CONSTRUCTION ON THE VIADUCT.

Upon the straight track the conductors are suspended from single catenaries, while upon the curves a double catenary is employed, and the conical insulator is inverted and supported in a casting bolted to the two vertical rods which drop from the catenaries. The vertical rods support a channel frame to which are bolted the conductors and the feeder cleats or clamps. Each joint of the conductor is bonded with a Chicago bond of two No. 0000 wires.

The feeder cables are of bare stranded copper of 61 strands each of 1,000,000 circ. mils cross-section. These are supported in iron cleats fastened to channel frames riveted to the overhead conductors at points near to the heavier channels to which the conductors are suspended.

The lead-covered primaries for the tunnel lighting plant are carried on posts set on the side of the cut, to the southern portal, where they drop to the tunnel and are carried upon porcelain knobs fastened to wooden blocks bolted to the masonry. At the points of support the cables are armored with wire to prevent abrasion. The secondaries are carried in cleats, also fastened to wooden blocks, similarly attached, and placed on either side of the tunnel about eight feet from the ground and 15 feet apart. They are, however, staggered, and thus occur alternately at every seven and a half feet throughout the tunnel. Each block carries a lamp at its lower end, and is there cut out so that the lamp socket may be protected from moisture and dripping water from the tunnel walls. The lamps used are 32 cp, 52 volt Edison standard incandescent lamps.

Detroit Railway Opened.

The electric railway system of the Detroit Railway Company was formally opened last Monday. Mayor Pingree acted as the motorman of the first car.

Hunt Narrow Gauge Railways.

The fact that narrow gauge railways for handling and transferring coal, castings, parts of machinery and materials of all kinds in and around manufacturing establishments constitute a very important element in the economy in the operation of a plant, is daily more fully appreciated, especially in a plant of considerable magnitude or where the various departments are in separate buildings. The saving in time and labor assured by the introduction of such a system, the increased efficiencies of other machines, or of the whole works, at once effected, the greater protection against damage afforded material while being handled or moved, and the general convenience, must be balanced against the interest on the investment and the expense of maintenance.

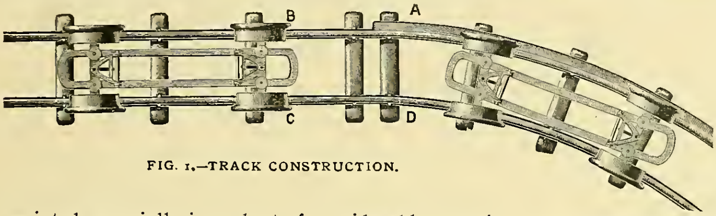


FIG. 1.—TRACK CONSTRUCTION.

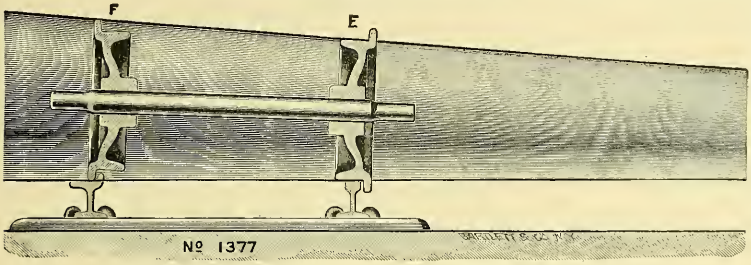


FIG. 2.—PRINCIPLE ON WHICH TRACK CONSTRUCTION IS BASED.

The industrial railways, illustrated herewith, are built by the C. W. Hunt Company, 45 Broadway, New York City, which has for many years given the subject careful consideration. In determining the gauge and the radius of the curves most suitable for an industrial railway, it is necessary to take into consideration all of the circumstances under which it is to be used.

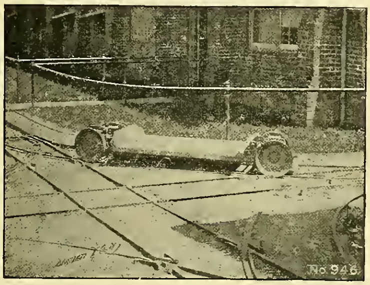


FIG. 3.—RADIAL POSITION OF WHEELS.

The C. W. Hunt Company believes that if the gauge adapted by it (21½ inches measured from the outside to the outside of the heads of the rails) is not the ideal one, it comes very near to it. In all of the railways that the company built it has never had a purchaser even suggest that a broader gauge would be better for any purpose. In a manufacturing establishment the curves should be of so short a radius that every part of a factory can be reached directly without expensive and troublesome turntables. The Hunt Company states that its standard curves are 12 feet radius measured to the centre of the tracks. This radius is almost exclusively used in manufacturing establishments where cars are usually moved by hand, because cars can be used with a running gear which runs as easily on a curve of 12 feet radius as on a straight line, the axles taking a radial position with the outer wheel running on a flange, instead of on the tread, thus enabling workmen to move double the load they could with ordinary cars. It is for this reason that the companies build railways with outside flanged wheels. These variations from ordinary railway practice make no difference whatever in the operation of the general construction, except that the curves, switches and frogs must be especially arranged to suit wheels with outside flanges.

The load which can be carried on a railway depends, not upon the gauge, but upon the strength of the track, consequently whatever strength is needed to carry a certain load can be obtained with a narrow gauge as readily as with the standard 4 foot 8½ inch gauge.

The Hunt cars are of improved construction and are fitted with a flexible wheel base, the axles taking a radial position on a curve, and the wheels and the curve are so proportioned that there is no slipping to cause friction. This departure from the old style of rigid-base cars is an important feature of the Hunt system.

The principle on which the cars turn a curve is illustrated in Figs. 1 and 2. A cylinder rolls on a plane in a straight line without sliding friction; a cone rolls on a plane in a circle about its vortex, without sliding friction. If both of the wheels of a car running on a curve have the same diameter as the cone would have, the wheels would run around the curve without sliding friction, the axles taking a radial position. Fig. 2 clearly shows that, if correctly made, there will be no sliding friction in passing the curve. In applying these principles the outer rail around the curve is made of special form so

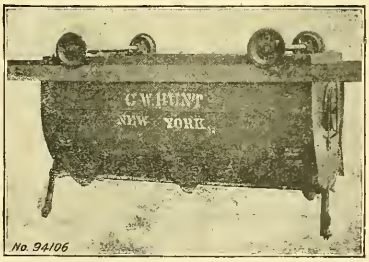


FIG. 4.—SPECIAL CAR TO RUN UNDER BOILER ROOM CEILING.

that the wheel runs on a flange instead of on the tread. The axle bearings are pivoted in the centre, between the wheels, permitting them to take a radial position, as the wheels direct.

Could the wheels be made absolutely round and exactly to the theoretical diameter, and the tracks perfectly smooth and laid to an exact circle, the cars would then pass around a curve as easily as on a straight track. It is impossible in commercial machinery to fully realize theoretical conditions, but the difference between the running gear as furnished by the C. W. Hunt Company, and the ideal ones, is claimed to be slight.

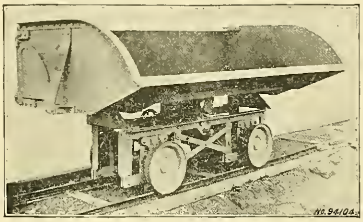


FIG. 5.—COAL AND ASH CAR USED BY CAMDEN STREET RAILWAY

Rigid wheel base cars do not run easily around a curve because one of a pair of wheels of the same diameter secured rigidly to the axle must slide on the rails a distance equal to the difference in the length of the inner and the outer rail. In a car having two pairs of wheels, with the axle boxes rigidly connected to the frames, not only must this sliding take place, but it is increased by the unfavorable position in which the axle holds the wheels, as the axles cannot take a radial position, which is the one most favorable. The C. W. Hunt Company furnishes cars of special design for carrying all kinds of material.

Comments and Views of Contemporaries.

Is This True?—The electric contagion has not affected the managers of the big roads that are not concerned in street railway traffic, and the men who run the great locomotives need not fear that they will have to become trolley motormen or quit the road.—*Railway Age.*

The Mighty Drayman.—Both law and public sentiment have been quite properly invoked for the protection of pedestrians from the peril of fast-running fenderless trolley cars. It is time both law and public sentiment were invoked and enforced to rotect the common, plain, everyday citizens who have trains to make, engagements to meet and work to do in factory, store and office, from the pig headed obstinacy of the mighty drayman, who assumes that he has a first right to the car tracks and a time and eternity lease of the privilege to occupy them.—*Philadelphia Times.*

Why Fenders Are Not More Readily Adopted.—One of the grave obstacles to fitting the trolley cars with fenders has been the lack of perfection in the production of a fender to accomplish its purpose. Every crank in the country with anything like an inventive turn of mind has his fender ready, but it is reasonably certain that the fender of the future is yet to be produced. Sufficient progress has been made, however, to enable the railway companies to furnish some measure of protection by adopting the best fender that can now be obtained, and they must do as all others do in dealing with the inventive spirit of the age—accept what is best to-day and wait for better to come.—*Philadelphia Times.*

Conduit Railways Wanted.—The time must soon come when some method of applying electricity to traction work shall take the place of the overhead wire and trolley. The demand for it is so urgent and so persistent on the part of the public, especially of the greater cities, and is supported so strongly by the interests of the owners and projectors of street railways, that the problem has enlisted the most active and diligent efforts of the electricians to solve it. So far as moving trains by electric power applied in other ways than by the trolley and overhead wire is concerned, the thing has already been done in a number of ways. But these methods, it is said, have proved more expensive than the trolley system, and the practical question is to find one which will be as effective and as economical as the latter. At least that is the reason given for not adopting them in this country.—*St. Paul Pioneer Press.*

Obstruction of Cars by Teamsters.—The railway companies suffer far less from these obstructionists than their patrons do. If an overloaded dray breaks down on a car track or plods at snail's pace up a long hill, blocking a dozen cars a half hour or more, the interruption to travel does not seriously diminish the revenues of the carrying company, but a dozen men miss a train, a score or more fail to keep important engagements and twice as many lose a half hour from their work. The loss to a hundred people is serious, and the gain to the obstructing drayman amounts to just nothing at all. Compel the draymen to have some regard for the rights of other people.—*Philadelphia Times.*

Trolley Excursions.—Not the least among the many benefits which city people derive from the trolley car is the opportunity for quick and cheap excursions into the country and to the shore resorts. The riding of those who use the cars for pleasure only forms not an inconsiderable part of the traffic of the street railways. To the tired worker or the sickly child, whose days and nights must be passed within the heated city, there is healthful tonic in a spin along quiet roads in the cool of the evening. The extension of the street railway far into the suburbs has brought such recreation within the reach of thousands of people for whom it was not possible before the trolley car made its appearance. A study of the faces that fill the cars coming in in the evenings ought to give pleasure to any humanitarian.—*New Haven Palladium.*

Best Fender Required.—It is absolutely necessary that our street railway companies should provide the very best fender within their reach for the protection of life and limb and we assume that that step will be taken to-day by all of them. The city was right in compelling the street railway companies to adopt a fender, but when that reasonable demand shall have been enforced, there remains a very important duty to be performed by the city. If our streets shall be used as playgrounds for children, as they could with safety a generation ago, there will be continued loss of life and limb in this crowded city, unless we go back to the provincial speed of the old omnibuses or horse cars. We must have rapid transit for the scores of thousands of working and business men who must reach their places of daily labor, and here as in every other large city of the world, everything must yield to that necessity.—*Philadelphia Times.*

FINANCIAL NOTES.

WORONO STREET RAILWAY.—The Worono Street Railway Company, of Westfield, Mass., is to issue $13,000 worth of stock and $35,000 bonds, and will use the proceeds for the electrical equipment of the road. The directors have authorized the executive committee, consisting of Col. J. A. Lakin. J. A. Crane and R. D. Gillett to select a site for a power station and install a plant.

REORGANIZATION OF THE NEW ORLEANS CANAL & CLAIBORNE RAILWAY.—The Canal & Claiborne Street Railway Company, of New Orleans, has been reorganized with the following new board of directors: J. W. Castle, president; Harris Hyman, J. K. Newman, I. S. West, L. Fabacher, Joseph H. De Grange and B. J. Montgomery. The following officers were elected: Joseph H. De Grange, president; B. J. De Grange, secretary. Ford & Bacon, of Philadelphia, were elected engineers of the road. It is proposed to equip the system electrically and bonds will be issued. Several extensions will also be constructed.

CHICAGO METROPOLITAN CAPITAL INCREASED.—The stockholders of the Metropolitan Elevated Company, Chicago, last Saturday voted to increase the capital of that company from $15,000 000 to $30,000,000. The new issue of $15,000,000 is to be preferred to the extent of 6 per cent. dividends, although the dividends are not to be cumulative and the stock may at any time be converted into regular common stock, share for share. It is the intention to issue no more bonds. The company originally had a capital of $15,000,000 common stock, and a mortgage was made authorizing an issue of $15,000,000 5 per cent. bonds. The construction company was to get all the stock and bonds for building the road, and has already disposed of $10,000,000 of the bonds and given $2,500,000 of the stock as a bonus. The construction company, therefore, holds now $7,500,000 stock of the elevated company, and would under the original contract have received $5,000,000 more stock and $5,000,000 more bonds on the completion of the road. This remaining $5,000,000 of the bond issue will not be made under the new arrangement, the construction company taking preferred stock instead.

ANNUAL REPORT OF THE WESTINGHOUSE COMPANY.—The annual report of the Westinghouse Electric & Manufacturing Company has just been issued. The report refers somewhat at length to the new works at East Pittsburg, which were erected, it is stated, during a period when extremely low prices for labor and material have prevailed, so that the cost is greatly below present prices for like work. As was expected, such extensive building operations and the removal of materials from the old to the new works reduced the output to about three fourths of what it would have been without the interruption and extra work entailed. The directors invite all holders of the company's stock to attend in person the annual meeting on July 17, at Pittsburg, in order to take advantage of the opportunity to see for themselves what has been accomplished and so form their own opinions of the efficiency of the plant and value of the property. Meanwhile the directors feel justified in adding that the works are as nearly perfect as they can now be made, and are working to the entire satisfaction of those in charge; the production has already been increased to a point where the demands of all customers can be promptly met and there appears to be no reason why the company should not be as large a producer of electric machinery as there is in the country. In anticipation of the increased facilities in the new shops a large amount of time and energy were put into the production of new and better forms of apparatus for the trade, and this extra work, together with that incident to occupying the new quarters, increased the expenses to a figure somewhat exceeding that of the year ending March 31, 1894. So far as ascertained, there were expended directly in removing, in machinery and in material, $90,499.54; after deducting this from the earnings from business and other sources, there is left the net profit of $711,909.68, which, however, scarcely represents half what might reasonably have been expected were it not for the conditions referred to above as to limitation of output.

NEW INCORPORATIONS.

THE FORT PITT STREET PASSENGER RAILWAY COMPANY, Pittsburg, Pa., capital stock $50,000, has been incorporated by Joshua Rhodes and others.

THE LITTE SAW MILL RUN STREET RAILWAY COMPANY, of Pittsburg, has been incorporated to operate a road from Pittsburg to Castle Shannon. The capital stock is $36,000.

THE PONTIAC TRANSIT COMPANY, Pontiac, Ill., has been incorporated by C. C. Strawn, I. F. Funk and L. S. Strawn, to construct a street railway. Capital stock $100,000.

THE INDIANAPOLIS, ANDERSON & MARION RAILWAY COMPANY, Indianapolis, Ind., has been incorporated by Noah J. Clodfelter and others, with a capital stock of $500,000.

THE SPOKANE TERMINAL RAILWAY COMPANY, Spokane. Wash., capital stock $1,000,000, has been incorporated by A. Openheimer, W. R. Newport, A. B. Hopper and H. A. W. Binket, to build and operate a railway.

THE SHEBOYGAN LIGHT, POWER & RAILWAY COMPANY, Sheboygan, Wis., capital stock $200,000, has been formed to supply light and power and to build an electric railway. The promoters are Geo. B. Matten, J. M. Saemann and F. L. Saemann, all of Sheboygan.

THE SYRACUSE & SUBURBAN RAILWAY COMPANY, Syracuse, N. Y., has been formed by W. B. Cogswell, O. V. Tracy and G. E. Higgins, Syracuse, N. Y., for the purpose of building and operating an electric street surface road in Onondaga County. The capital stock is reported as $250,000.

THE BUFFALO, NORTH MAIN STREET & TONAWANDA COMPANY, Buffalo, N. Y., capital stock $75,000, has been formed to operate the Buffalo, North Main Street & Tonawanda Electric Railway Company. S. W. Petrie, T. H. Feary and J. H. Pardee, Buffalo, and J. F. Farrell, Albany, N. Y., are interested.

THE GREENWICH & SCHUYLERVILLE ELECTRIC RAILWAY, of Greenwich, N. Y., has been formed with a capital stock of $200,000, to build and operate an electric railway. Martin Schenck, Troy; Jas. Mealey, Schuylerville; A. M. Crandall, Middle Falls, and Robert Hamilton, Greenwich, N. Y., are the incorporators.

PATTERSON HEIGHTS STREET RAILWAY COMPANY, Beaver Falls, Pa., capital stock $6 000, has been incorporated for the purpose of constructing and maintaining an electric railway. Among the promoters are John Reeves, Henry M. Meyers, Harry W. Reeves, James F. Merriman, and John T. Reeves, Beaver Falls, Pa.

THE DALLAS CITY STREET RAILWAY COMPANY, Dallas, Tex., has been incorporated with a capital stock of $500,000, to construct and maintain a street railway in Dallas to be operated either by horse, electric or cable power. The promoters are Frank Clark, Baltimore, Md.; C. L. Blackford, Denison, Tex.; I. L. Sale, Dallas, Tex.

THE INTER-OCEAN ELECTRIC RAILWAY COMPANY, Chicago, Ill., capital stock $200,000,000, has been formed to construct, equip, own and operate electric railways, both surface and elevated, and to erect and operate telephone and telegraph lines, etc., etc. Among the interested parties are Jas. C. Hulse, Parker Crittenden and John W. Hill.

GRAND BOULEVARD STREET RAILWAY COMPANY, 1942 North 17th Street, Philadelphia, Pa., capital stock $50,000, has been incorporated for the purpose of constructing and operating an electric railway. Among those interested in the project are O. M. Thomson, 1942 North 17th Street; Chas. P. Horr, John McLennon and Thomas C. McConnell, all of Philadelphia.

PEORIA & FORT CLARK STREET RAILWAY COMPANY, Peoria, Ill., capital stock $150,000, has been formed to acquire, build, buy, own and operate street railways and plants for producing electricity, and to use, furnish and sell electricity for operating street railways, for light, heat and power purposes. The incorporators are William Burry, Emory D. Frazer and Charles S. Williston.

NEWS OF THE WEEK.

SYRACUSE, N. Y.—The City Council has passed ordinances giving the Syracuse Street Railway Company the right to build two extensions.

NEWBURYPORT, MASS.—The Board of Aldermen has granted the People's Street Railway Company an extension of time in which to build a line through Storey Avenue to West Newbury.

WASHINGTON, D. C.—The Washington & Great Fall Electric Railway of which J. P. Clark is president, and W. E. Lewis, secretary, has sold bonds to the amount of $100,000 for the purpose of constructing its electric railway.

TOWSON, MD.—A stock company has been formed by Geo. S. Metter, Dr. W. Crim, S. J. Carr, of the Carr-Lowery Glass Company, and Wm. F. Porter, of Johns & Porter, and others, for the purpose of building an electric railway to connect Mt. W[illegible]ns, Westport, Lansdowne and Metter's Park with Baltimore. The capital stock is $75,000.

PHILADELPHIA, PA.—The city solicitor has filed a bill in equity on behalf of the city against the commissioners of Fairmount Park, William Wharton, Jr., and the Fairmount Park Transportation Company. The object of the proceeding is to prevent the construction in the park of a railway until the consent of the city has been first obtained.

JAMAICA, L. I., N. Y.—Col. A. A. DeGrauw, one of the wealthiest men and a large stockholder in the Jamaica & Hempstead Plank Road, has asked the Town Board of Jamaica to postpone proceedings to have the road condemned, as he is about negotiating with an electric railway company to build a trolley line over this route from Jamaica to Hempstead.

DAYTON, O.—The Dayton Traction Company has announced that arrangements are perfected whereby the road will be completed, and the electric line between Dayton and Miamisburg will be in operation by Sept. 1. This line is part of the system in contemplation between Dayton and Cincinnati, and it is said that Mayor Major, of Toledo, is one of the financial backers of the Dayton branch.

PHILADELPHIA, PA.—The Board of Directors of the Electric Traction Company has ordered the immediate construction of the extension to Fox Chase. Residents of Fox Chase and of the other suburbs that will be given access to the city by the new line have been urging the company to construct the extension for a long time. The franchise to build the line was granted by the Council last year, and the places for the tracks have been approved by the Board of Surveyors and Highway Supervisors.

BALTIMORE, MD.—The Baltimore & Catonsville Construction Company has issued specifications for the building of the double-track electric railway between Baltimore and Washington. The bids are to be opened in Baltimore on July 20. The specifications cover the construction of the road, the necessary bridges, the power stations, with their equipment, the car barns, cars and car equipment, and everything necessary for the running of the road. The company which has the franchises is the Columbia & Maryland Railway Company, and it has secured by lease or consolidation street railways in both Baltimore and Washington that will give an entrance into the centre of each city. The specifications call for 95-pound girder and 85-pound T rails, with stone ballast. There will be a steel bridge over the Patapsco River, near Baltimore, 600 feet long and 200 feet high. The approximate length of the road will be 40 miles, and it is proposed to build two power stations, one at a distance of 10 miles from each terminal, thus giving 20 miles of road for each station to supply power to. There are to be two classes of cars, one with bodies about 25 feet long, and the other shorter. The motors are to be capable of a maximum speed of 60 miles an hour.

PERSONAL.

MR. ARTHUR H. LOWERRE, 20 years ago president of the Atlantic Avenue Railway Company of Brooklyn, died at his home in that city last Saturday.

TRADE NOTES.

THE CHARLES SCOTT SPRING COMPANY, of Philadelphia, Pa., has just issued a new catalogue devoted to springs for street railways. The standard elliptic springs are first described and illustrated, and the rest of the catalogue is devoted to helical brush holder trolley and sash springs. The pamphlet contains views of the company's wareroom and machine shop, spiral department and elliptic departments. The company states that its long experience in the business, combined with the use of high-grade crucible steel, the newest and best machinery, and the employment of skillful workmen, justify it in claiming that its springs are in all respects unequalled.

FREDERICK E. BRUCE, formerly manager of the Sterling Company in Cleveland, O., has been appointed manager of the New York office of the National Water-Tube Boiler Company, of New Brunswick, N. J. Mr. Bruce's office will be at 74 Cortlandt Street.

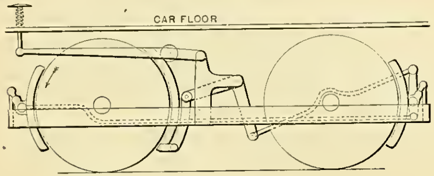
THE ABENDROTH & ROOT MANUFACTURING COMPANY, of New York, makers of the Root improved water-tube boiler, recently received a cable order for three 113-hp Root boilers, to be shipped to Johannesburg, South Africa. Export trade is improving with this company.

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED JULY 2, 1895.

541,838. RAIL BOND; Patrick Cunningham, New Bedford, Mass., assignor of one half to John W. Cornell, same place. Filed April 1, 1895. The rail bond comprises eyeletted pins or rods inserted through holes in the rail and split or divided. A tie wire is inserted in the eyes of the rods and secured therein.

541 849. RAILWAY BRAKE: Charles F. Grather, New York, N. Y. Filed May 11, 1894. The brake mechanism comprises a frame with brake shoes thereon. Elongated slots receive the vehicle axle and are adjustable therein. Levers are pivoted to portions of the frame and toggle links are pivoted to the levers and have connection with the vehicle axles so that they may move the latter in the slots in the frame. The toggle links are provided with cams adapted to travel under projections on the brake frame to raise the latter when the vehicle axles have resumed their normal positions with respect to the road.



Street Railway Gazette

No. 542,089.—CAR BRAKE.

541,866. BRAKE FOR RAILWAY CARS; William Main, Brooklyn, N. Y. Filed Oct. 17, 1890. A swinging cross-bar carries brake shoes and a compound lever is connected to the bar and operates it so as to apply the brake. A swinging member supports the compound lever independently of the brake shoe and a spring or springs are provided for returning the bar and lever to their normal positions.

541,871. STORAGE HEATER FOR STREET CARS; James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, same place. Filed March 13, 1893. One or more drums are located on each side of the car, which is suitably connected with piping. A trap is arranged in that end of each drum out of which the water passes. About midway between the ends of the car the trap communicates with the drum and a vent within the pipe communicates with the drum near the bottom. The piping is provided with a check valve on each side of the car so that the water can circulate in one direction only.

541,914. FENDER FOR STREET CARS: George Berkley, Newark, N. J Filed Aug. 16, 1894. The fender consists of a frame with upper and lower fenders pivoted thereon with their axles contiguous, a cushion being sustained between the fenders adjacent to the axles.

541,928. SNOWPLOW FOR STREET RAILWAYS: John H. Graham, Boston, Mass. Filed Jan. 7, 1895. The body is pivoted to rock vertically on the truck and carries shares for engaging the roadway. A tank on the body contains liquid, and dispenses the weight thereof at corresponding sides of the pivot as the body is rocked.

541 954. SWITCH MOVEMENT; John B. Trisler, Westwood, assignor of one half to Joseph H. Moore, Cincinnati, O. Filed April 1, 1895. This is a device for operating rail switches from cars. A vertically sustained angle lever has one member reaching through a slot and partly projecting above the street surface for operation from the car. This member has a normal tendency to return after operation to its first position within that end of the slot from which it had been moved. The other member below is toothed and intermediate mechanism is provided whereby this toothed member and the angle lever transfers the effect of its operation to the switch.

541,969. TROLLEY WIRE CLIP; Fred W. Hauesgen, Buffalo, N. Y. Filed Oct. 9, 1894. The clip consists of an elastic sheet metal support; its upper separate end having apertured projections which register when the wire is in position, and which can be pulled apart to admit the wire within the support. There is a removable wedge-shaped clamp provided with a groove in its lower side. There is a socket in its upper portion, the shank consisting of the upper portion which is adapted for screw-threaded engagement with the insulating bell or hanger. The lower screw-threaded portion with the downwardly extending projection is designed for engagement with the socket in the clamp. There is an annular shoulder between the two screw-threaded portions and an elongated nut.

541,983. BRAKE FOR RAILWAY CARS; Robert L Omensetter, Philadelphia, Pa., assignor to the J. G. Brill Company, same place. Filed July 25, 1894. The car axle has a horizontal groove therein, and a key consisting of a rectangular plate has a projecting rib which is seated in the groove and projects beyond the surface of the axle. The car wheel has intersecting grooves adapted to engage with the outer end of the key and with the rib thereof. The drum or disc has a groove for engaging with the inner end of the key and the securing bolt.

542,002. TROLLEY-RESTORING ATTACHMENT; William D. McDaniel, Philadelphia, Pa., assignor of one half to Luther S. Green, same place. Filed Oct. 29, 1894. Restoring pulleys are mounted on bearings which are independent of the bearings of the trolley wheel, and have a space at their inner ends, the diameters of the pulleys being greater than that of the wheel.

542,036. ELECTRIC LOCOMOTIVE; Thomas E. Adams, Cleveland, O. Filed Oct. 3, 1894. This is a combination of car axles, of motor casings and flexible connections between the motor casings and axles. A bar having a sliding connection with the casings and flexible connection between the casing, at points between the ends of the bar.

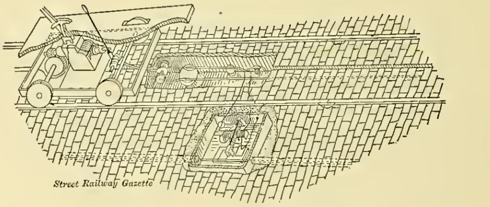
542 037. ATTACHMENT FOR STREET CARS; John W. Barnes, Rockland, Me., assignor of one half to Stephen Chase, George Smith, Max Antin and Alfred Murrey, same place, and Charles Stimpson, Thomaston, Me. Filed March 18, 1895. This is a braking device for street cars. A frame is pivoted to the axle of the car and a spur wheel is journaled in it and driven from the car axle. Springs are provided for forcing the frame normally downward with lifting devices at the front of the car. A spring connection is interposed between the frame and the lifting device.

542 047. STREET CAR FENDER; Peter R. Foley and Michael F. X. Foley, Philadelphia, Pa. Filed Oct. 23 1894. The fender consists of two parts, one being secured to the front of the car, and the other part, which is an apron, is mounted upon suitable supporting wheels. The two parts are connected by a slotted hinged joint, the slot therein being vertical, so that the apron will oscillate on the wheels as a fulcrum and permit the depression of the front end of the apron when an object is struck.

542,069. DOOR MOVEMENT FOR STREET CARS; John A. Tackaberry, New York, N. Y. Filed Feb. 15, 1893. The sliding doors have rails above them, and wheels are mounted on brackets which are attached to the upper part of the doors. There are guide pulleys provided with chains passing around them, and rods connected to the chains and extending to the brackets in different vertical planes.

542,089. CAR BRAKE; William H. Masterman, Oakland, Cal., assignor to the Masterman Car Equipment Company. Filed March 4, 1895. The device consists of a segmental shoe movable to and from the periphery of the wheel, and an anti-friction roller is adapted to press upon the back of the shoe, mechanism being provided by which it can be applied upon the shoe and the latter forced into contact with the periphery of the wheel so that the shoe is caused to travel in the direction of the movement of the wheel. Connecting rods and levers are interposed between the sliding shoe and the brake shoe, so that the movement of the sliding shoe is transmitted when the brake is applied. (See Illustration.)

542,090. MECHANISM FOR OPERATING RAILWAY SWITCHES; Albert R. Moore, Houston, Tex., assignor of one tenth to Charles N Fisher, same place. Filed Nov. 10, 1894. Claim 1 reads as follows: "The combination with a car or other similar objects, of the lever, the inclined arms secured thereto, the rearwardly extending bar, the triangular casting or lever, pivoted to a bearing secured to the car and to the rear end or corner of which said bar is pivoted, the rod pivotally connected with the other end or corner of said casting or lever and wheel journaled to said rod, the construction being such that when said casting or lever is depressed by the link bar and connections, the pivots of the casting, the link bar and the wheel will be in alignment with each other."



Street Railway Gazette

No. 542,105.—CONDUIT ELECTRIC RAILWAY.

542,105. CONDUIT ELECTRIC RAILWAY: Leonidas C. Pressley, San Francisco, Cal. Filed Feb. 13, 1895. Insulated conducting rails are supported in line alternately on each side of a central line. Trolley wheels connected with the cars are adapted to travel alternately upon one rail and the succeeding one. Electromagnets with movable armatures are adapted to make connection between the main conductor and the terminal end of each rail when energized, means being provided for energizing each preceding magnet from the succeeding rail. This is accomplished by overlapping the rail so that two trolleys are temporarily traveling upon the two rails. Means are provided for cutting out the preceding rail as soon as the succeeding one has been energized. These consist of a second electromagnet by which a swinging armature is attracted when the second magnet is energized. A short independent rail section and a wire connect with this magnet, the rail section being so disposed that when the trolley leaves the preceding rail it passes over this independent section and through it energizes the electromagnet whereby the armature is attracted and contact with the conducting plate and connection with the previous rail is broken. (See Illustration.)

542,164. CONDUIT ELECTRIC RAILWAY; Louis R. Lavalle, and Albert H. Lavalle, Holyoke, Mass. Filed March 17, 1894. The switch and trolley wires have bent ends and the supporting and insulating blocks carry the wires. The blocks have recesses in their bottoms to receive fastening nuts on the wires, insulating cushions being arranged between the wires and the blocks.

Electric Railway Gazette.

Vol. XIII. NEW YORK, JULY 20, 1895. No. 3.

New Jersey Electric Railway Company.

The Jersey City, Hoboken & Rutherford Electric Railway forms an important part of a trunk line of about 50 miles in length. The entire system, under the name of the New Jersey Electric Railway, has now been completed and is in operation throughout, with the exception of a short section in Hoboken. The latter, it is expected, will be in operation within a short time. The Jersey City, Hoboken & Rutherford division of the system consists of about 15 miles of double track, extending from Barclay and Christopher streets in Hoboken, through Jersey City Heights, Union Hill and Homestead to Rutherford. On that portion of the line from Homestead to Rutherford extending over the Hackensack meadows, the cars are operated at a speed of from 20 to 25 miles per hour.

The new power station of the company, Fig. 2, which has just been completed, is located about midway between Jersey City and Rutherford, on a tract of land containing about 30 acres, owned by the company. The land extends back to the Hackensack River, and at this point the car house and repair shops as well as the power station have been built. The latter is a substantial fireproof structure, built of brick, with dimensions of 100 by 164 feet. The roof is of slate and is supported by steel trusses which were supplied by the Pennsylvania Steel Company. The building consists of two bays, one of which contains the engines and generators and the other the boilers and pumps.

The engine equipment at present consists of two cross-compound Corliss engines, which are directly connected to Westinghouse multipolar generators, Fig. 1. The engines were built by the Bass Foundry & Machine Works, of Fort Wayne, Ind., and are nominally rated at 500 hp each, although they have frequently developed 800 hp without manifesting any strain. All parts of the engines are very heavy, especially the main shaft and bearings. The latter are 28 inches in length and 14 inches in diameter. The shafts at the largest section in the centre are 21 inches in diameter. The fly wheels are 18 feet in diameter and weigh 55,000 pounds each. The bed casting is especially designed for heavy duty and the metal is so distributed as to prevent twisting or torsional strains. The guides are bored cylindrical in form, the centre of the piston rod being in the centre of the circle. An important feature in the design of the bed consists in the fact that the section, extending from the guide barrel to the main bearing, differs from that found in the usual construction. It is carried to a height above the centre line of the shaft, a departure which adds greatly to the strength of the frame. The main pillow blocks are massive, and the boxes are provided with horizontal adjustment for taking up the wear on each side and with vertical adjustment for taking up that at the bottom. The crank pins, cross-head pins and connecting rods are all made unusually heavy. The valves are of the Corliss type, and are so designed that the use of springs is made unnecessary, and it being four inches longer than the cylinder,

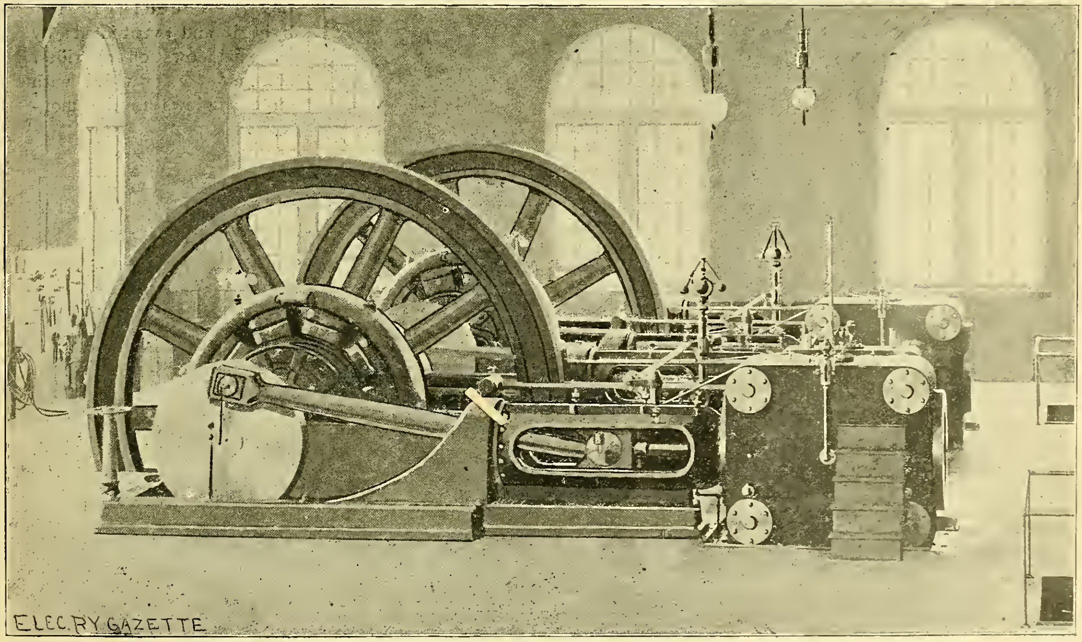


FIG. 1.—ENGINES AND GENERATORS.

the velocity of the flow of steam is reduced to considerably less than 100 feet per second. The steam and exhaust valves are actuated by independent eccentrics and wrist plates, allowing a perfect distribution of steam when running either condensing, non-condensing or compound. Another important feature is found in the design of the hooks for actuating the wrist plates. The ordinary hook must be raised or lowered on the wrist plate pin when throwing in or out of gear. This method is regarded as objectionable when double gear is used. The hook rod passes through a sleeve which is pivotally attached to the wrist plate to afford an allowance for the vertical movement to the rod. A cam arrangement is attached to the sleeve, and is provided with a pin which is adapted to engage the corresponding hole in the rod. The arrangement is very simple, and greatly reduces the difficulty which attends throwing the engine in or out of gear. The governors are of the Porter swing ball type, and are arranged to operate the cut-off of both high-pressure cylinders. They are provided with a sliding weight speed adjustment and an automatic stop motion for shutting off steam in case the governor belt should break. Since the plant was started the engines have given great satisfaction, and have been found to regulate very closely under the variation of load which always accompanies street railway work.

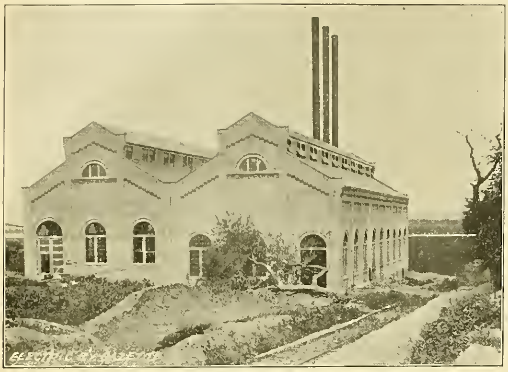


FIG. 2.—EXTERIOR OF POWER STATION.

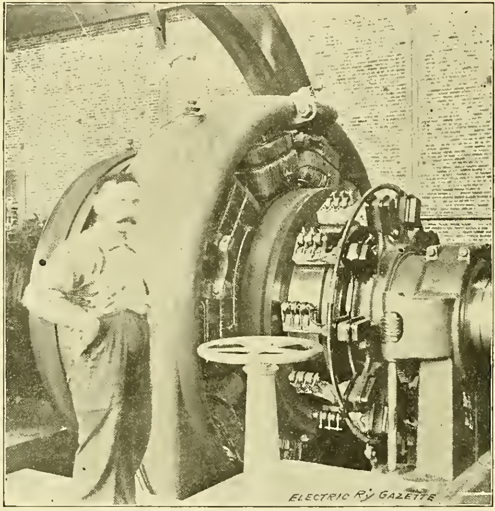


FIG. 3.—ONE OF THE GENERATORS.

The power house being on somewhat swampy ground it was expected that piling would be necessary, but solid rock was found at a depth of about eight feet below the surface, which afforded an excellent base for the engine foundations. The generators, Fig. 3, are of the multipolar type of 370 kilowatts capacity each, and were furnished by the Westinghouse Electric & Manufacturing Company. The generator leads, as well as all of the steam piping, is under the engine room floor.

The switchboard, Fig. 4, is of the standard Westinghouse type, and is located in the centre of the south side of the room, far enough from the wall to afford ample room for the examination of the connections. It is constructed of white marble panels about eight feet in height, equipped with Westinghouse instruments, and is so arranged that it may be extended as the plant is increased.

The station is equipped with a complete oiling system which possesses several novel features. In the engine room is a cast-iron tank of 60 gallons capacity, from which the oil flows by gravity to the bearings. The drip flows to the basement beneath the engine room, where it first passes through a strainer, thence through a filter to a tank similar to that in the engine room. This tank is connected by a pipe to the condenser, which forms a vacuum in the tank, forcing the oil up to the tank in the engine room and thence it again flows by gravity to the bearings. This tank has a carbon filter in the bottom, through which the oil must pass, so that the drip before returning to the bearings passes through a strainer and two filters.

A traveling crane of 20 tons capacity, built by the Pennsylvania Steel Company, is provided for handling the machinery when necessary. The crane is equipped with two hoists, designed by the company's engineer especially for this plant, which greatly facilitates the handling of the machinery. The plant is so arranged that provision is allowed for increasing the capacity to 5,000 horse-power, by the addition of four 1,000 horse-power units. The building is exceedingly well lighted and ventilated by large windows on all sides, and is also provided with large windows in the monitor roof.

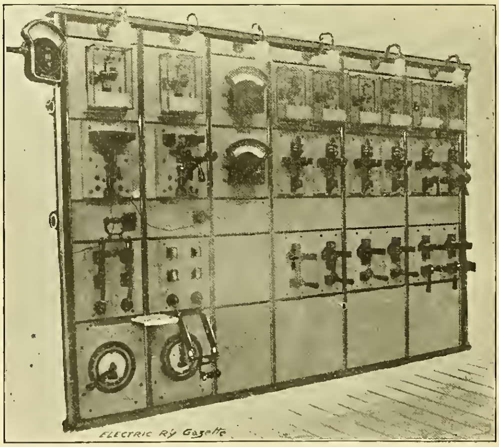


FIG. 4.—SWITCHBOARD.

The positive feed wires, which are of 500 000 circular mils, pass from the switchboard through vitrified pipe to a point about ten feet away from the building, and thence upward through a brick pier about eight feet in height and extend from there to the poles, as shown in Fig. 5.

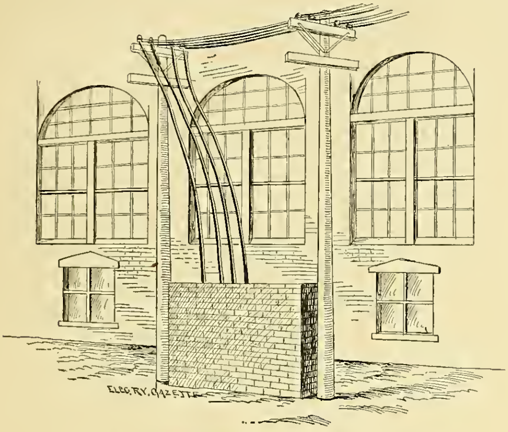


FIG 5.—FEEDERS LEAVING BUILDING.

(*To be Continued.*)

Blockading a Turnpike.

Llanarch, a little town in Delaware County, Pa., about three miles from the Philadelphia city line, has been, this week, the scene of hostilities between the West Chester Turnpike Company and the Pennsylvania Railway Company. The trouble grew out of the construction of the Philadelphia & Castle Rock Rapid Transit Electric Line, the owners of which have merged interests with the turnpike company. The electric road is to cross the Pennsylvania Railway at Llanarch, and the right to cross at grade is claimed under an agreement with the turnpike company. The Pennsylvania Company recently instituted proceedings to prevent the grade crossing, and a temporary injunction has been granted.

On last Monday the Pennsylvania Company decided to blockade the turnpike, in order to prevent the electric railway company from attempting to lay the crossing. An engine was sent to the spot, accompanied by 35 men, and the crossing was thoroughly protected against any encroachment on the part of the electric railway company. The latter disclaimed any intention of doing work at this point, and expressed their willingness to obey the court order. The Pennsylvania Company evidently did not believe in the sincerity of the assertion, for it kept several engines at the spot.

The locomotives, it was alleged, frightened the horses of passing teams, and on Tuesday, Joseph Leedom, secretary of the turnpike company, swore out a warrant for the arrest of the engineer and fireman of one of the engines, on the charge of obstructing travel on the pike. When an attempt was made to serve the warrants the employees resisted and were not taken into custody. The conflict, which promised to be exciting at one time, did not develop any interesting incidents, and the companies are now agreed to await the decision of the court, before taking any further action.

Some Practical Hints for Motormen.—VIII.

BY GEORGE T. HANCHETT.

There are two principal methods of connecting electric motors with a simple field coil and armature, viz.:

First. The fields and armature in series.

Second. The fields and armature in multiple.

A motor connected in series is shown in Fig. 23, and one connected in multiple in Fig. 24. These are called respectively *series* and *shunt* motors.

Series motors are used exclusively on railway cars, and, therefore, their properties will be somewhat minutely discussed. It is necessary to consider a property of all motor armatures first.

The armature of any electric motor, as it revolves in the magnetic field provided by its field magnets, has generated in its wires an E. M. F. exactly opposite to the current existing therein. If this E. M. F. were strong enough it would stop the current entirely. As it is, it greatly reduces the current that would otherwise flow. This E. M. F. is called the inverse or back E. M. F. of the motor. It depends upon three different things for its magnitude. Two of these quantities are liable to vary, while the third is a constant quantity for any one motor. They are as follows:

First. The number of lines of force passing through the armature of the motor which we will call f.

Second. The speed of the motor in revolutions per second denoted by S.

Third. A constant quantity K.*

The relation between these quantities is such that

$$e = f \times S \times K.$$

Thus we see that the greater the speed or the greater the strength of the magnetic field, the greater will be the back E. M. F., e.

The value of E may also be deduced in another way, which is very instructive. If we call the resistance of the armature R and the current flowing in it C, then by Ohm's law, the E. M. F. necessary to force the current through the armature = $C \times R$, and the difference between this E. M. F. and the E. M. F. impressed on the motor = the back E. M. F. Calling the impressed E. M. F., E,

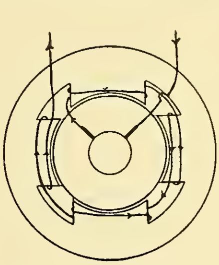


FIG. 23.

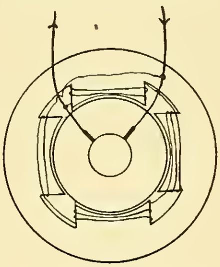


FIG. 24.

$$e = E - CR.$$

From this the current that any motor takes can be readily deduced.

$$C = \frac{E - e}{R}$$

and it is easy to see that the difference of the E. M. Fs. E and e is effective in producing current.

Now from Fig. 22 it can be readily seen that the trolley current is compelled to enter the field magnet and pass through it. Then it passes through the armature to the ground. A good armature of any type is designed so as to have as low a resistance as possible. Less energy will be wasted in forcing current through a low resistance armature. The resistance of railway armatures is some small fraction of an ohm.

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* K is usually equal to the number of conductors counted around the periphery of the armature divided by 100,000,000.

Now, if the railway armature were subjected to the full 500 volts, as it would be if it were a shunt armature (see Fig. 24), it would be obliged to depend upon its back E. M. F. almost entirely to keep back the enormous current which 500 volts would be capable of forcing through such a low resistance. Hence, if for any cause, such as the slowing down or stopping of the motor under a heavy load, this back E. M. F. was to cease, a fuse would be blown or an armature burned out, and in any event the insulation would probably be scorched. This is a circumstance which the railway motor must be designed to resist.

This is accomplished by the series method of connecting. The dynamo pressure has to encounter the added resistance of the field and armature in forcing current through the system. In the absence of the back E. M. F. caused by the armature being stationary, the resultant current will not be nearly as great as if the field and armature were in multiple. But this method of connecting helps in two other ways as well.

When the armature, due to a heavy load, slows down, as it would in climbing a steep hill, the back E. M. F. diminishes and more current flows. However, this large current flows in the *field magnet* as well as the armature, and the former is greatly strengthened thereby. This tends to keep the back E. M. F. from falling off, for though S is diminishing, f is increasing. Second, the strong field and strong current in the armature give the latter a powerful turning effort or torque, as it is called, for this torque is directly proportional to these two quantities. This added tendency to turn will keep the speed of the motor up even though the work required of it is great.

We may now compare the relative properties of series and shunt motors on circuits supplying electricity at constant pressure.

SERIES MOTOR.	SHUNT MOTOR.
1. *Resistance.* Relatively great from terminal to terminal preventing, to some extent, heavy currents when stalled or heavily loaded.	1. *Resistance.* Relatively small from terminal to terminal. Tends to absorb enough current to keep the speed nearly constant, whatever the load.
2. *Speed.* Other things being equal, varies with load.	2. *Speed.* Other things being equal tends to keep constant.
3. *Back E. M. F.* Tends to increase when heavy current is drawn from the line.	3. *Back E. M. F.* Tends to diminish when heavy current is drawn from the line.
4. *Effect of heavy load.* The motor having more work to do slows down. This, however, does not involve an excessive current, and the motor becomes possessed of a greater torque to meet the load. This extra torque being given by both field magnets and armature.	4. *Effect of heavy load.* The motor slightly slows down, but tends to keep its speed constant, and to obtain the necessary torque calls for an excessive current which is liable to blow out a fuse or burn out an armature. This extra torque is provided by the armature, only the field magnets rather falling off in this regard than otherwise.
5. *Effect of no load.* Tends to have an excessive speed.	5. *Effect of no load* Speed very slightly increased.
6. *Torque.* Relatively great with given current.	6. *Torque.* Relatively small with given current.
7. No speed regulation.	7. Approximate regulation for constant speed.

There are two important mechanical quantities in the action of any motor, viz.: Torque and speed. Thus far we have only superficially alluded to them, and having several times made bold statements of facts concerning them without giving the whys and wherefores, it is wise to consider them a little more minutely.

Torque, often called turning moment or starting effort, is measurable in a definite quantity. It is the product of the force exerted on the surface of the armature in pounds, and the radius of the armature in feet. A powerful torque is very desirable on a railway motor, for, with a given horse-power, the greater the torque the less need be the speed. The ideal aimed at by many manufacturers is to produce a motor with sufficient torque and moderate speed, so as to admit of directly coupling the armature to the car axle without interposition of gears

The torque of any electric motor depends upon the product of three factors, and, in fact, is equal thereto. These quantities are:

The current in the armature $= C$.

The strength of the field magnet $= f$ in lines of force.

A constant quantity for any one motor $= X$.

The relation being such that $T = CfX$ where $T =$ the torque.

Railway motors are so designed that a heavy current will produce a torque sufficient to skid the wheels, rather than allow the motor to come to rest. Hence, there is always back E. M. F. to keep back excessive flow. There is one case, however, in which excessive current will flow in spite of all that can be done, and can only be stopped by the blowing of a fuse. This is the case of the rapid reversal of the motor, and will be taken up further on.

The speed of a direct-current series motor depends upon the E. M. F. to which it is subjected, and the strength of the magnetic field.

It can be shown that

$$S = \frac{E - C R}{f K}.$$

Where $E =$ the applied E. M. F. $C =$ the current flowing, and $R =$ the resistance of the motor, the other letters having the meanings heretofore given them. R is usually so small that $C R$ may be neglected, and the equation becomes

$$S = \frac{E}{f K}.$$

Thus the greater the E. M. F. impressed, the greater the speed; also the weaker the field, the greater the speed. This equation we shall find very useful in the study of the action of the controller.

Before closing this section it may be well to consider the action of a quickly reversed motor, as we are now in a position to do so.

If we return to our primitive experiment with the revolving wire and its circle of magnets, we will notice that a reversal of current *while the wire is in front of any one pole*, reverses its direction of rotation. Or, if we keep the circuit in the wire the same *and reverse the lines of force* by changing the poles presented to the wire, we shall produce the reversed motion. Similarly, if we reverse the current in the armature of a railway motor leaving the current in the field unchanged in direction, or vice versa, we shall reverse the motor.

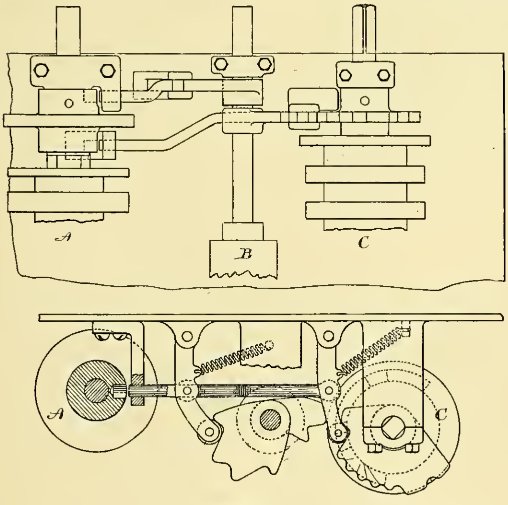
If a railway motor going at full speed ahead is suddenly reversed, either by reversing field or armature, the same result occurs. The back E. M. F. now has the same direction as the current in the armature. In fact, it is no longer a back E. M. F., but one which combines with the impressed E. M. F. to produce an enormous current The torque which this heavy current produces is in the reverse direction from the rotation of the motor. This brings the motor to rest very quickly. On the stopping of the motor the E. M. F. generated in its wires ceases and the current falls off considerably. Still it is very excessive. The motor now starts in the reverse direction, and as it does so, an inverse E. M. F. is generated which gradually increases with the speed and chokes down the current to its normal value.

It is, however, rare that the fuse fails to blow in such cases. The brushes usually spark very badly, and the average motorman has doubtless found that the whole reversal takes place with much more commotion in the motor box than this description of it would indicate.

(*To be continued.*)

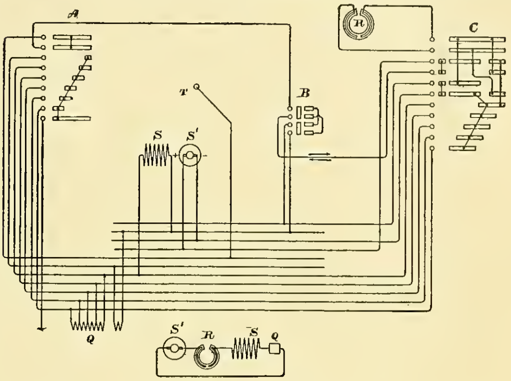
Electric Brake.

An electrically operated braking mechanism for electric cars has recently been patented by W. B. Porter, of Schenectady, N. Y., who has assigned the patent to the General Electric Company. The braking apparatus is designed to be operated by the current from the motors when they have been reversed and act as generators, as a result of the momentum of the car. The controller consists of three cylinders, a controlling cylinder for the motors when operating as motors, a brake cylinder or controller for the motors when reversed and operating as generators, and a receiving cylinder or switch. These three cylinders are provided with separate handles and an interlocking mechanism, which is designed to prevent improper manipulation. The interlocking mechanism is also so arranged that a different throw is permitted to the brake cylinder when the car is going in one direction from that allowed when it is moving in the opposite direction. Under ordinary circumstances it is unnecessary to arrange the brake so that it will operate when the car is moving backward, as the backing of cars is contrary to the rules of most street railways, but in some cases where a car is run backward for a few feet, as on a switch or turnout, it is sometimes necessary to stop abrupt. For making such emergency stops the brake is arranged so that where there are successively graduated effects in applying it when running forward, this part of the cylinder remains idle when the car is moving backward, and an auxiliary set of contacts comes into play, which apply the full force of the brake at once.



FIGS. 1 and 2.

The general construction of the controller is shown in Figs. 1 and 2. With either the series-parallel controller or the ordinary resistance switch the contacts upon the braking switch cylinder co-operate with the controlling cylinder. These connecting contacts make possible an important economy in the car wiring, as a considerable length of wire can be saved in equipping the circuits of the apparatus. The controller, as shown in Figs. 1 and 2, is provided with two bolts serving as an interlock between the reversing switch and the controller and between the brake switch and controller. Lugs secured to the controller case have openings which form guides for the interlocking bolts and the shaft of the controlling switch is provided with two notched collars, with which the ends of the bolts register. The notches indicate the off position of the controlling switch, and it is only in this position that it is possible to operate with the brake or reversing switch.



FIGS. 3 and 4.

The circuits employed in the braking apparatus are shown in Figs. 3 and 4, in which *A* is the controlling switch, *B* the reversing switch, and *C* the brake switch. *S'* represents the motor armature, *S* the motor field magnets, *R* the brake shoe, *Q* the resistance, and *T* the trolley. The resistance in this case is employed both to regulate the motors and their action as generators in the braking apparatus.

The brake switch acts by means of the contacts to cut out sections of the resistance regulating the amount of current passing through the brake shoe and its consequent attraction for the co-operating disc on the car wheel.

British Street Railway Statistics.

An English paper gives the following statistics of the street railways of Great Britain: Altogether 37 civic authorities and 110 companies own tramways in the United Kingdom. On these tramways 30,528 horses, 564 locomotives, and 4,179 cars are used. The number of men employed is about 20,000. The total number of passengers carried during the year 1894 was 616,872,830. The gross receipts were £3,615,837, and the net profit £758,781, giving a return of 5¼ per cent., or an increase of 1 per cent. on the previous year.

Legal Tender of Fare.

BY R. D. FISHER.

What constitutes a legal tender of the required fare to ride in a street car has been the subject of much speculation and no little litigation. Companies operating as common carriers under charter are usually limited to a stated amount as one fare for a given trip, but the rules and regulations concerning the payment thereof is a matter of adoption by the carrier. Whether the matter of making change for a passenger by the conductor is merely one of convenience or of necessity and lawful compulsion, need not be determined at this time, but the denomination of money value which he is legally bound to receive and change is one of vast concern to the management of street railways. It is customary for a conductor in charge of a car to carry a stated amount of money for the purpose of making change, but in case a bill or coin is handed him in payment of a fare or fares of a money value greater than the aggregate amount of his change, can he require the passenger to make the even change, if not can he be required to leave the car, or shall he be carried and a collection of the fare subsequently made if at all? The question of pennies is also one of considerable annoyance to conductors and not infrequently they are refused in payment of fares.

Lawful money of the United States is lawful money of any State or Territory. (Wharton vs. Morris, 1 Dall. U. S., 124.) A covenant to pay a sum in "lawful money" is satisfied by the tender of the nominal value of such sum in legal-tender money. (Davis vs. Barton, 52 Pa. St. 9.) A *legal tender* is an offer to do a thing conformably to the requirements of the law in the case; that is, money that may be validly offered in payment of a debt. (Anderson's Law Dic.)

While Section 3585 of the Revised Statutes of the United States provides that the gold coins of the United States shall be a legal tender in all payments of their nominal value, if such coin has fallen below the standard weight and limit of tolerance provided by law for a single piece, a conductor may lawfully refuse to accept it in payment of fare or fares unless a corresponding reduction of its value be agreed upon in proportion to its actual weight.

Section 3586 of the same statute provides that the silver coins of the United States shall be a legal tender at their nominal value for any amount not exceeding five dollars, in any one payment; and Section 3587 provides that the minor coins (dimes, nickles and pennies) of the United States shall be a legal tender at their nominal value for an amount not exceeding twenty-five cents in any one payment. Under this section a conductor may not legally refuse to accept pennies for a single fare, and whether one fare or five fares are paid by one passenger for others the conductor is bound to accept pennies to the amount of twenty-five cents in payment thereof. They are single fares and single payments notwithstanding the tender is made by one person. Suits are now pending in Chicago, Indianapolis and Toledo to test several of the questions as to what constitutes a legal tender of fare to ride in a street car.

From an examination of existing decisions it would appear that, as a general rule, in order to constitute a valid tender of the payment of fare, the exact amount must be offered, but if a street railway company permits a passenger to enter its car without demanding the payment of his fare in advance, a relation of debtor and creditor is established, and the enforcement of a rule requiring the tender of the exact fare would not only be impracticable, but clearly unreasonable and illegal. (See Tarbell vs. St. Ry. Co., 34 Calf., 616.)

In the absence of regulations by a street railway company of which the public have reasonable notice, fixing the maximum sum which may be tendered, or the greatest denomination of legal money acceptable and changeable by the conductor, what amount would be a reasonable tender in any given case is a question which cannot be, nor is not determined by any rule derived from the decisions now on record. It has been held, however, that there is a distinction between railways whose passengers may pay their fares at a ticket office or station, and street railways where they are obliged, or permitted according to custom to pay upon the cars. In the case of Barrett vs. Street Ry. Co. (81 Calf., 296), it was held that a passenger was entitled to damages on account of being ejected from a car after having tendered five dollars in gold, and upon his refusal to leave the car upon demand of payment of the exact fare. The Canadian courts have made a similar ruling. (See Fulton vs. Ry. Co., 17 U. C. Q. B., 428.) Where a genuine silver coin, worn smooth by use, but not diminished in weight, distinguishable, was presented to a conductor who refused it, and ejected the passenger for refusal to make any other payment, he may have an action for damages, as the coin was a legal tender. (Morgan vs. St. Ry. Co., 52 N. J. L., 60.)

Whether several passengers could collude together and each tender the conductor a coin or bill of large denomination which he could not change and by reason thereof remain upon the car is a question not yet passed upon by the courts; such collusion, however, would be in the nature of a fraud or conspiracy and would not find favor with the courts of equity.

Where passengers are entitled, upon the payment of a single fare, to be carried, the carrier may adopt and enforce reasonable regulations for the convenience of passengers, and may also enforce reasonable regulations to prevent imposition in the matter of a legal tender of fare, and while a regulation against the acceptance of pennies would be unreasonable and illegal, a carrier may reasonably and legally refuse to accept and change a coin or bill of large denomination in payment of a fare.

Brooklyn Real Estate and Speed of Cars.

The reduction in the speed of electric cars in Brooklyn by the city ordinance has had the natural result of taking out of the market considerable real estate for which there would be a demand, if it could be quickly reached. The real estate men of the city have joined in a petition to the City Council, asking for a modification of the city speed regulation, on the ground that reduced speed of cars is detrimental to business interests and to the development of the outlying districts.

Philadelphia Trolley Party.

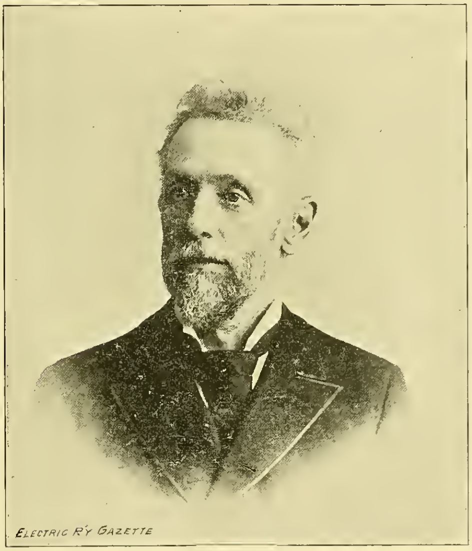
The largest trolley party which has ever been arranged was enjoyed by over 3,000 persons in Philadelphia, last Thursday evening. Sixty-one cars were operated, run in blocks of four and five, so that the general traffic should not be interfered with. They were brilliantly illuminated, and several brass bands contributed music. The party was organized in aid of the German Hospital, of Philadelphia, and about $500 was realized. The People's Traction Company furnished the cars free.

Street Railway Engineers.—XII.

LEO DAFT.

The name of Mr. Leo Daft will always be associated with pioneer work in the electric railway field. He was born in Birmingham, Eng., in November, 1843. His father was Thomas B. Daft, a prominent civil engineer. He early showed a leaning toward mechanical and electrical pursuits, and in 1859 entered the University College, at London, as a special student in civil engineering under Dr. William Pole, F.R.S., and at that time became acquainted with Sir William Siemens, who lent him a considerable amount of electrical apparatus for carrying on his experiments.

Mr. Daft came to America in 1866, and first engaged in railway engineering, afterward in various minor enterprises. He went to England in 1879, but upon his return to this country, about two months later, the developing activity in electrical matters attracted his attention, and recalled him to his old profession. His first connection was with the New York Electric Light Association, which was soon merged into the Daft Electric Light Company, with works first in New York, then in Greenville, N. J., and later in Marion, N. J. The company was almost immediately and exclusively devoted to the development of electric power, and established several electric power stations in Boston, New York, Worcester and elsewhere. In 1883 Mr. Daft built an electric locomotive called the "Ampere," for use on the Saratoga & McGregor Railway, and in the following year installed a short line at Coney Island. In the early part of the Spring of 1885, he was requested to furnish an electric equipment for the Baltimore Union Passenger Railway Company, and on Aug. 8, 1885, this road was put in operation, continuing uninterruptedly for four years, or until the Autumn of 1889, without change of rolling stock or station apparatus, and, in the light of recent events, it is interesting to note that the four independent motors were of the single-reduction type, towing 16-foot trailers, and the regulation was series-parallel; the four spools of each motor being so connected to th controller without the use of any external resistance whatever. It has recently been said that "the Daft road at Baltimore was particularly successful in demonstrating, in the face of general opinion to the contrary, that several cars could be worked in parallel from the same line, and that there was ample power for running around curves and mounting heavy grades."



LEO DAFT.

The first motor cars were the "Morse" and the "Faraday," and a third insulated rail was used. The Daft system was adopted on a number of roads, and the Daft locomotive, "Ben. Franklin," was operated for some time on the Ninth Avenue Elevated road in New York City.

Regarding Mr. Daft's work in the stationary distribution of power by electricity, the following is quoted from *The Electrical World* of March 30, 1889: "It deserves mention here that in 1884 *The Electrical World*, desiring to make an exhibit at the Philadelphia Electrical Exhibition, determined to print its issue there by electricity. It was easier, however, to form the plan than to carry it out, but the Daft Company guaranteed a successful performance, and Mr. Daft himself took a hearty interest in the project. The generator, motor and press were duly set up, and within the five weeks of the exhibition 80,000 copies of the paper were printed from electrotypes, the type being set in New York. We have reason to know that this feat, besides attracting universal attention, gave, at a critical time, a direct and lasting impulse to the electric motor industry in this country.

"As one example of the development of electric power, in New York alone, it will be sufficient to state, in the portion of Manhattan Island bounded by Chambers, Broad and Canal Streets, about 700 hp is now daily distributed by the Daft system to some 200 consumers in quantities varying from one half to 30 hp. All the apparatus, including motors, generator, switches, meters, etc., is of Mr. Daft's design, and we believe there is no other installation of the kind in that respect in the world. In other words, Mr. Daft is the only inventor so far who has taken up the problem of the distribution of power electrically, and worked it out in the same manner as the distribution of current for lighting—providing and perfecting the necessary apparatus throughout."

Mr. Daft, who is a member of the A. I. E. E., is now engaged as a consulting electrical engineer on the Pacific Coast, with headquarters at Los Angeles, California, and is turning his attention chiefly to long-distance power transmission and large railway and light installations. During the last few years he has installed a number of interesting plants in the Western States.

Application for Receiver.

An application for a receiver for the Central Jersey Traction Company has been made by Lemuel Miller. He alleges that the company is insolvent, with liabilities of $225,000, of which $25,000 is due him for work in constructing part of the road between Raritan and Bound Brook, and the remainder is due for bonds issued. The bill filed says there are no assets, except a contract with the New York & Philadelphia Traction Company to construct and equip an electric railway, and the contract is without present market value. Vice-Chancellor Pitney, at Trenton, on Thursday last, granted a rule requiring Frank A. Magowan, president, and Joseph H. Reall, general manager of the company, to show cause, at Newark, on July 23, why a receiver should not be appointed for the company. A temporary injunction was granted restraining the company from contracting debts or mortgaging or disposing of its property until after the hearing.

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PHILADELPHIA FENDER CASES.

The suits which have been begun in Philadelphia to collect penalties from local street railway companies, because of their alleged failure to equip cars with fenders, have disclosed the fact that the situation in that city is not different from that which existed in Washington when the local companies were made defendants in similar proceedings. The Philadelphia companies have found it physically impossible to comply with the ordinance within the prescribed time limit. It was argued that they should have begun the work of equipping their cars at an earlier date, but this argument is based upon the assumption that the selection of a proper fender was a task which could be quickly accomplished. The reverse is the fact. One of the witnesses for the prosecution, an abstract of whose testimony appears elsewhere in this issue, made the statement that he had examined between 200 and 300 fenders, and that he was not prepared to say that any one of them was without pronounced faults. A street railway officer testified to the examination of fully as many life guards, and his conclusion was not essentially different. It appears to have been the fact that, before the investigation undertaken by the companies demonstrated which was the best type of fender to be adopted, they were forced to begin the work of equipping their cars in order that they might not render themselves liable to heavy penalties for noncompliance with the ordinance. It was found to be impossible in the time which remained to complete the work within the period prescribed by the municipal regulation. Under these circumstances it would seem manifestly unfair to visit penalties upon the companies, and we expect to see the court follow the precedent set by the Washington judge who refused to impose fines upon companies for failing to do what was impossible. The fender cases in Philadelphia involve another point which is perhaps of greater interest than that alluded to. Some of the cars are equipped with types of guards which it is maintained by the city officers do not meet the requirements of the ordinance, and very likely the court will be called upon to pass upon the interesting question of what constitutes a fender.

WHAT IS A LEGAL TENDER OF FARE?

The question of what is a legal tender of fare is one which is constantly arising on street cars. We mentioned in a recent issue that suit had been begun against a Chicago company by a complainant who alleged he had been ejected from a car because he had tendered the conductor five pennies for his fare. Another incident occurred, we believe, in Long Island City, where a conductor who was unable to change a bill retained possession of it until he reached the company's office, in spite of the protests of the passenger who desired to alight before reaching that point. Not long ago four persons, each with a twenty-dollar bill, attempted to ride all over the city of Indianapolis, relying upon their knowledge that the conductors ordinarily carried change only to the amount of $15. Disputes on street cars over plugged or defaced coins are of constant occurrence and not infrequently threaten to precipitate personal encounters between conductors and quick-tempered passengers. The question of a legal tender of fare which is of interest to all companies is discussed in this issue by Mr. R. D. Fisher. It appears from existing decisions that, as a general rule, in order to constitute a valid tender of the payment of fare, the exact amount must be offered, but if a street railway company permits a passenger to enter its car without demanding the payment of his fare in advance, a relation of debtor and creditor is established, and the enforcement of a rule requiring the tender of the exact fare would not only be impracticable, but clearly unreasonable and illegal. In the absence of regulations, Mr. Fisher states, by a street railway company of which the public have reasonable notice, fixing the maximum sum which may be tendered, or the greatest denomination of legal money acceptable and changeable by the conductor, what amount would be a reasonable tender in any given case is a question which cannot be determined by any rule derived from the decisions now on record. He finds, as a general conclusion, that companies are warranted in enforcing regulations to prevent imposition, and may reasonably and legally refuse to accept and change a coin or bill of large denomination in payment of a fare.

EXHIBIT AT THE MONTREAL CONVENTION.

Preparations for the next convention of the American Street Railway Association, to be held in Montreal, Oct. 15 to 18, have commenced in earnest. We print elsewhere in this issue a statement from the executive committee, in reference to the exhibit of street railway apparatus. It is proposed to make this feature of the meeting one of great interest and attractiveness, as it should be. Victoria Rink has been secured for this purpose, in which the electrical exhibit was placed at the time of the Montreal convention of the National Electric Light Association, in 1891. This building affords ample space and its location is desirable, as it is in close proximity to the hotel which has been selected as the headquarters of the association. We trust that manufacturers on this side of the boundary line will cordially co-operate with the Canadian companies in making the exhibition a success. We know that the latter will spare no effort, but certainly the former were at first disinclined to take an active interest in the enterprise. They argued that an exhibit shipped to a city in the United States necessitated a considerable outlay of time and money, but if sent to Canada would be even more expensive while at the same time the bother of red tape customs regulations would be encountered. We trust their views in this respect are undergoing a change, and we believe they are. The statement of the executive committee which we print is likely to remove their apprehensions on the score of the bother and expensiveness of sending goods through the custom house. The committee has planned to reduce to a minimum the cost and the annoyance. We certainly believe that it will prove advantageous to manufacturers to be represented by exhibits. Unless all signs fail there will be a large attendance of street railway men in Montreal, as every inducement will be held out to attract them to the meeting. There never was a time when greater interest was taken in apparatus and supplies of an improved description than at the present time. If a manufacturer has something worth showing he will have no difficulty in attracting the interest of the practical men who will be present at the convention. To a considerable number of manufacturers an exhibit may open the way for transacting business with Canadian companies, at least in a limited way, despite the existing high protective tariff. We certainly hope to hear that our manufacturers are preparing enthusiastically to make the exhibit successful.

Street Railway Exhibition at Montreal.

The executive committee of the American Street Railway Association announces that Victoria Rink in Montreal has been secured for the street railway exhibition to be held in connection with the convention commencing Oct. 15. The location is convenient, as it is near the Windsor Hotel, which is to be the headquarters of the association. Supply companies which propose to make exhibits are requested to make application to Stonewall Jackson, local secretary, 17 St. Sacrament Street, Montreal, Quebec. The executive committee has made an arrangement with M. Davis, customs broker of Montreal, for a reduction in custom house charges on goods to be exhibited as follows: Warehouse and bond entry, $1; export bond entry, $1; making and procuring consular certificates, $1. When goods to be returned are valued at $50 or more a consular certificate which costs $2.50 must be procured, but this is unnecessary in the case of goods which are valued at less than $50. The fees therefore to be paid for goods under the value of $50 would be $2; and $3.50 would be added to that when a consular certificate is required.

Shippers should mark goods with their own name, and "Care of M. Davis, Montreal, for exhibition purposes," prepaying the freight, and sending invoices marked "certified correct," and signed. On arrival, Mr. Davis will make warehouse bond entry, and have goods delivered at the Victoria Rink.

When the exhibition is over, the owners of the goods will have to re-pack them, using preferably the same cases that the goods came in, and they will be returned under the export bond. They must be careful not to make more packages of the goods in sending them out than they had in bringing them in, and it is a distinct advantage to have them in the same cases, so that the marks on these cases may be identified. Consignors must pay all freight and cartage.

The following rules and regulations have been adopted:

Space will be allotted on Aug. 1 to all exhibitors whose applications have been filed with the secretary and accepted on or before that date. Applications for space received and accepted after Aug. 1 will be allotted remaining space, if any, in the order of their acceptance.

The space will be charged for at the rate of 15 cents a square foot, and no space less than 50 square feet will be rented, nor more than 1,000 square feet unless by special arrangement with the secretary.

Space allotted cannot be transferred without permission and must be taken possession of on or before Oct. 9.

Articles placed on exhibition cannot be removed without the written permission of the secretary.

All goods shipped to the exhibition should be plainly marked "Street Railway Exposition, Montreal, Canada." It is advisable to secure a time-limit delivery. Be sure to allow plenty of time for transportation.

On and after Oct. 8 exhibitors and their agents and workmen will be admitted to the building for the purpose of preparing necessary structures. The general reception of articles for exhibition will commence on Oct. 9.

Exhibitors of machinery in operation must have everything in running order, in readiness to start their machinery on the morning of the opening day.

All goods intended for exhibition must be on the premises and properly displayed on or before Monday evening, Oct. 14.

Exhibitors must provide all counter shafts, pulleys, belting, switches, switchboards, etc., necessary for the operation of their machinery.

No platform or other structure must be nailed to the floors or walls.

Exhibitors must not place any sign or circulate advertisements, except such as pertain to their own business (and those only in their own space), without written permission from the secretary.

Electric power will be furnished to those who use power. The charge therefor during the entire time of the exposition will be 45 cents per rated kilowatt of machine actually using current. The minimum charge for power will be $15.

All machinery will, if possible, be exhibited in motion, and should be kept in motion at regular work during the hours 9 to 12 a. m., 2 to 6, and 7 to closing p. m.

Parties desiring to sell and deliver in the building any articles whatever, must first obtain a written permit from the secretary for such consideration as may be determined upon.

Any permit to sell may be revoked at any time, at the pleasure of the association.

Every possible precaution will be taken to guard against fire, and a full corps of watchmen will be on duty day and night; but the association will not be responsible for loss or damage to articles on exhibition, by theft, fire or otherwise.

The association reserves the right to charge an admission fee to the citizens of Montreal should it so determine, but the admission of exhibitors and their agents will be free.

Electricity on Steam Roads.

A steam railway paper, after referring editorially to the interesting features of the electric locomotives in the Baltimore tunnel, says, in reference to the electric traction on steam roads: "Next in interest is the operation of the Nantasket Beach Line of the New York, New Haven & Hartford, seven miles long. The Pennsylvania Railway also has a short piece of line operated by electricity; while it is currently reported to be more or less definitely decided to try the change on the Chicago Northern Pacific out of Chicago, on the St. Paul & Northern Pacific between St. Paul and Minneapolis, on the Chicago, Milwaukee & St. Paul between Chicago and Evanston, and on the Cincinnati, Hamilton & Dayton between Cincinnati and Hamilton."

Fender Suits in Philadelphia.

Five suits were begun against the Philadelphia Traction Company to recover penalties for its alleged failure to equip cars with fenders in accordance with the terms of the city ordinance. This measure provided that all cars should be equipped within 90 days after its passage, or by June 25. There are several types of wheel guards or fenders on the cars of the Philadelphia Traction Company, which the city contends are not fenders in the meaning of the ordinance. The police have been reporting the cars equipped with such appliances daily since the ordinance went into effect, but the five suits brought were test cases, one for each of the five types of wheel guards or fenders which are regarded by the city authorities as inefficient. The penalty is $10 a day for each car run without a fender since June 25. After July the penalty will be $40 a day for each car.

Henry D. Loss was put on the stand, on behalf of the city, as a fender expert. He said he had been a mechanical engineer for 13 years, and when asked to state his opinion of the fender on the Ridge Avenue cars said that, though it was intended as a safeguard, it was a source of danger. He said the bumper of a car, on striking a person, would undoubtedly knock him down, and, unless he fell crosswise of the track, the fender would be likely to go over him. Mr. Loss then gave his estimate of the result in case a person weighing 150 pounds was struck by the bumper of a car weighing about 16,000 pounds, at speeds of six, nine and 12 miles an hour. At six miles an hour, or nine feet a second, the body would be shot forward 18 feet, corresponding to a drop of five feet and an energy of 5 hp. At nine miles an hour a body would be shot 27 feet, corresponding to a direct fall of 12 feet, and an energy of 7½ hp. At 12 miles an hour, or 18 feet a second, a body would be thrown 36 feet, corresponding to a drop of 20 feet and an energy of 10 hp. Mr. Loss also spoke of the danger from the projecting drawbar. On cross-examination by the counsel for the company, Mr. Loss said he had never been engaged in the manufacture of fenders, nor in the management or operation of street cars, and he never saw the actual collision of a body with a car. He admitted that his deductions were based on theory, and said he had never been struck by a fender, or he would not be testifying.

When asked his opinion as to the second fender complained of, Mr. Loss said it also left the front of the car unprotected, and in shoving a body out of the way was likely to jam it under the step of the car. As a general principle, he said, no fender is successful unless it first breaks the impact in front and then picks up the body.

Mr. Loss said that he did not know of any fender that would surely save life. The difficulties were great, but there are plenty of fenders better than the two he had been giving his opinion of. The problem, Mr. Loss thought, could be solved by the application of good mechanical theory proved by actual practice.

When Mr. Widener, of the Philadelphia Traction Company, offered him $100,000 in cash to produce or invent a perfect fender, Mr. Loss declined to accept the challenge.

Charles F. Franklin, chief trolley inspector of the city of Brooklyn, took the witness stand and said he had examined 200 or 300 fenders. The two fenders under discussion, Mr. Franklin said, were like a type which he had investigated and found wanting, inasmuch as it had fatally injured a child.

On cross-examination Mr. Franklin said he had been trolley inspector five months, having passed a civil service examination. Prior to his assuming that position he had been a sign painter. He had seen tests of fenders he thought good, but did not know of a perfect fender. Mr. Shapley, the company's representative, objected to the evidence of Henry B. McIntire, the draughtsman of the Electrical Bureau, who was sent to Brooklyn, Newark and Baltimore to investigate the fender question, because Mr. McIntire said he was not an expert. The magistrate decided to hear his testimony, however. It was to the effect that the bumper and dasher ought to be protected, and there should also be a fender under the car.

With these witnesses the city closed its case. Before calling any witnesses, Mr. Shapley addressed the magistrate as follows: "Long before this ordinance was passed the company had been experimenting with various fenders, trying to find the very best that had been invented, and had adopted two kinds, as the best, and had ordered several hundred of them. The Ridge Avenue cars had all been equipped with the Crawford fender. It was adopted for this line as more suitable and safer than one projecting a considerable distance in front. Because of the narrowness of the street and the sharp curves, it was believed that a projecting fender on the Ridge Avenue cars would cause more accidents than it would prevent. The company had also ordered several hundred cars on other lines to be equipped with the projecting fender. Upon the passage of the ordinance the company promptly ordered these projecting fenders to be put on every car, the contractors positively agreeing to do so within the time specified in the ordinance. And to-day every car on every one of its lines is actually equipped with a fender. You will observe that the ordinance imposes a penalty only in case of the neglect or refusal to comply with it. In our case there has certainly been neither neglect nor refusal to comply, for, as we have fully complied, no one can pretend that there has been any refusal. The law does not demand the performance of impossible things. This was precisely the view taken of a similar case in Washington. The companies made every reasonable effort to put on the fenders within the time specified, but found it impossible to do so. When warrants were issued, and when the cases came up before the court, it allowed each company such extension of time as was necessary, and did not impose the prescribed penalties."

Vice-President George D. Widener was Mr. Shapley's first witness. He related his experience in the examination and testing of 200 or 300 fenders, saying the matter was taken up before the ordinance was passed, because accidents were numerous and costly. He told the magistrate why, in his opinion, it would be impossible to use projecting fenders on Ridge Avenue. The front fender, Mr. Widener said, was adopted for the other lines, and several were ordered before the ordinance was passed. After it passed the manufacturer was directed to go ahead and equip all the cars, and on June 25 only about 10 per cent. of the company's cars were not equipped. Now every car is equipped with either the Standard projecting fender or the Ridge Avenue type. Mr. Widener admitted to Mr. Farr that the order to equip all the cars was not given until two or three weeks after the ordinance passed.

Mr. Young, agent for the company supplying fenders to the Philadelphia Traction Company, testified that, though work went on night and day and Sunday, it was impossible to get the fenders all made before June 25. He said the order to equip all the cars was given early in May. R. E. Kemper and John L. Gauner and Nicholas F. Hoefner, president of the fender company, gave similar testimony. The court reserved decision.

Northwestern Electrical Association.

The third convention of the Northwestern Electrical Association was held in Chicago, Wednesday, Thursday and Friday of this week. The convention was opened with an address by the vice-president, George Grimm, as the president of the association, Henry C. Thom, had died since the last meeting. In the course of his address, Mr. Grimm said:

"Your former president, Mr. Paige, in his last annual address, forcibly called attention to the magnitude and importance of the electrical industries of the country, representing an investment of several millions of dollars, and creating results so pre-eminently beneficial to the public that simple justice demanded an honest consideration from every government, municipality and individual. But that, instead, there was constantly waged against these and kindred enterprises an infamous and communistic warfare, antagonistic to the true principles of our institutions and government. At the conclusion of the address it was remarked that it presented rich food for reflection. And it does; reflection on our part as well as on the part of the general public. We may take it as an indispensable truth that no evil, no sentiment destructive of or foreign to common fairness can live and grow under a government based upon and deriving its power from the consent of the governed, without the existence of a like evil to give it nourishment. The very basis of this government is equal justice to one and all, not as an idle phrase printed upon a statute book, but as a principle living in the heart of each individual. If, therefore, we see an evil growing in the community, one that works injustice or injury, we should find the cause that has dulled the sense of justice in the people and permits the evil to exist. In our case the cause should not be hard to find. How many corporations who are enjoying valuable franchises granted to them as gifts by the municipalities conduct their business with any other thought or subject in view than the profits to be made? They will improve the service or extend their lines if they must, or if they will gain additional patronage; but every move is actuated either by expected gain or public (municipal) compulsion. Complaints of poor service, irregularity, overcharge, and the like, are utterly ignored until recognition is compelled by public sentiment or authority. Competition is kept out, destroyed or made harmless by combinations. Every effort is directed to the earning capacity, frequently for the purpose of forcing, by its dividend-paying qualities, a stock, originally watered, up to par. Every concession requested by the community that gave it the possibility of existence is resisted until the patience of the public is exhausted, and sentiment becomes inimical to an industry that should have received united support and commendation. This sentiment of dislike and clamor for municipal ownership of the quasi-public industries, like electric lighting, gas works, water works and the like, is the natural outgrowth of either unduly large profits extorted by the line of policy above referred to, or by lack on the part of the managers of proper regard for the rights of the people. I fail to find any other cause.

"The root of it all is that some of these corporations seem unable to realize that their business is not strictly private, but semi-public in its character, and should be managed accordingly. While, undoubtedly, most of these industries are run upon a broad gauge plan, regardful and mindful of the rights and wishes of the public, yet it must be evident to all that there are many that are liable to every charge of the evils complained of. The public never stops to discriminate in passing judgment, and the result is that general sentiment becomes hostile to all alike, and ready to accept any plan of relief or retaliation which may be suggested, even as against industries which are not at fault and which would innocently suffer. Thus the agitator and pot-house politician find ready soil to receive their seeds of communistic doctrine, and willing ear for the abuse of others and self-glorification.

"It is to this subject that I invite your consideration, both as individuals and as a body. We are dependent upon the public good will; a contest is destructive to our interests. We should use our influence in every possible direction to gain and hold this good will. The business is hazardous at best, and we cannot afford to add additional risks, such as public ill will would bring."

Comments and Views of Contemporaries.

Fender Problem.—There never was any question that the fender problem could be satisfactorily settled if the railway companies went about it in the right spirit. All that is required is the stimulus of actual demand, and not mere talk about the necessity for something of the sort. The public has had enough of that and is looking for action.—*Brooklyn Eagle.*

Speed and Safety.—Experts, indeed, say that, in running trolley cars, express trains, or twin-screw steamers, there is less danger to life and limb at high speed, when competent hands are at the brake, the throttle and the helm, than when they are driven on the jog trot, go-as-you-please schedule of indifferent and half-disciplined service. —*Brooklyn Citizen.*

Grade Crossings.—A law enacted two or three months ago by the Connecticut legislature now in session forbids the crossing of steam railway tracks by trolley road tracks at grade in that State. This legislation was procured by the arguments and influence of the New York, New Haven & Hartford Railway Company, and should be placed to the credit of that corporation by all who use steam roads or trolley roads in Connecticut. There should be in every State a law requiring a separation of grades at points where trolley lines cross the routes of steam lines.—*New York Times.*

Rain and Open Cars.—The open cars on showery days are made something of a nuisance owing to the fact that passengers are expected to use their clothes to wipe up the water on the seats and the heat of their bodies to dry the same into a passable degree of comfort. It takes only a light shower to wet both ends of each seat so that only two passengers at the most can obtain a tolerable sitting thereon. The rest must either stand up or soak up the water with their clothing and possibly catch a cold into the bargain. It would cost the company but a trifle to provide an acceptable way of escape. If some absorbent cotton waste or cloth were carried on each car and used by the conductor or even given to the passenger to use in wiping up the water from a seat when it is about to be taken, a great deal of discomfort to the passengers would be done away with.—*Springfield Republican.*

Electricity on Steam Roads.—No subject is just now occupying more of the attention of railway men than the question of the possibility of the application of electricity as a motive power to the general railway business of the country. Three years ago when two of the largest railways in the United States almost simultaneously appointed committees of their officers to investigate the feasibility of supplanting steam with electricity on a large scale, the two committees, working independently, arrived at the same conclusions—conclusions adverse to the proposed change. During the last three years, however, there have been great advances made in the practical application of electricity to transportation; but even now one of the highest authorities on the subject in the country has expressed himself as strongly urging railways to wait yet awhile longer, at least for a twelvemonth, during which time he expects further great advances to be made.—*Railway Age.*

A Duty for the Police.—It is not possible for parents to keep their children off the streets. Boys will be boys; girls will be girls, and they will frolic and play as best befits them. They do not appreciate the increased perils which are gradually growing up in a great city to those who occupy the streets, and because they could play marbles or give a Buffalo Bill performance on the streets some years ago with reasonable safety, they will not understand why it is impossible now. There is but one power that can keep children from the streets, and that is the power of the police. There is not a day that scores of children cannot be seen playing on the streets occupied by trolley lines in every part of the city, and until they are forbidden by the police, and arrested when they disobey the order of the city authorities, there will be no safety for children, fenders or no fenders. Children must be protected by a stronger power than themselves, and the only power that can protect them in a great city is the power of the municipality.—*Philadelphia Times.*

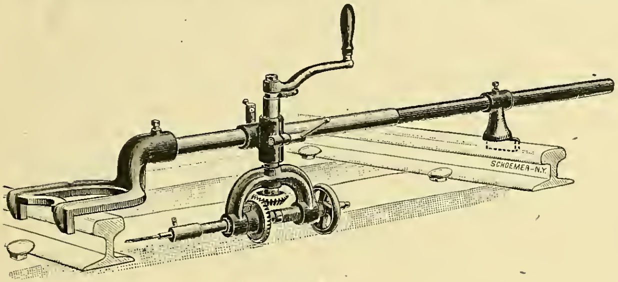
Philadelphia Trolley Mail Service.—Naturally the gratifying success of the preliminary experiment of collecting and distributing city mails by the trolley cars has led to the consideration of a wide extension of this method. There are other long-distance lines and branch lines upon which the trolley mail-car service can be adopted quite as successfully and profitably as over the line upon which the first experiment was made. Electric railway lines radiate in every direction from the postoffice, and if the selection of a site had been made with a view to the adoption of a collecting and distributing service like that just introduced a better location than Ninth and Chestnut streets could not have been found. The mail cars on Fourth and Eighth streets have ceased to be a novelty and are considered as much a part of the every-day traffic of those thoroughfares as the drays and passenger cars. They will soon cease to be a novelty in any section of the city and are destined in the near future to practically supplant the mail wagons which have for many years constituted a conspicuous feature of the city's mail service. The change will cause no regret, for it will be a change in the direction of a quicker and better distributive service.—*Philadelphia Times.*

Young Women Conductors.

The management of the street railway in Rome, Ga., recently allowed a women's society to collect the fares on the cars for a day and devote the proceeds to charity. The plan appears to have been successful so far as raising money was concerned and gave rise to many humorous incidents, as young women acted as conductors.

Track Drill.

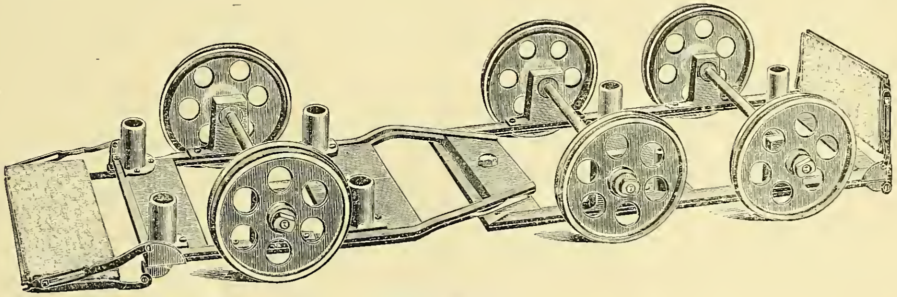
The accompanying cut illustrates a new track drill which the Millers Falls Company, of Millers Falls, Mass., is introducing. It is designed for drilling rails for bond wires and tie rods. The company states that the drill with horizontal shaft, as shown in the illustration, is more suitable for the work than the types with upright standards heretofore furnished by the company. Each drill is provided with two sets of gears so that it may be speeded or geared back. A check is provided with each drill for holding drills smaller than one quarter inch.


SCHOEMER-N.Y.

TRACK DRILL.

Thompson High-Speed Truck.

In the six-wheel car truck shown in the accompanying engravings the car-supporting coil-springs are located in the pedestals under the followers that are connected to the detached frames pivoted to the ends of the car. By this construction the frame is allowed to turn in accordance with the radii of a curve and under the guidance of the inner section of wheels supporting the sectional frames. The journal bearings or steel hubs are rigidly secured to the axles offering the increased diameter so much desired in high-speed trucks to prevent hot journals. The wheels are substantially secured to the axles by the axle nuts, which are prevented from unscrewing by a key that passes through the nut and axle. The wheels may be detached from the axle without interfering with the electric motor or journal boxes or the brakes. The fender is connected with the frames of the car truck and may be folded up in the rear of the car if so desired; when in position it is rigid as a cow-catcher of a locomotive and in no way affected by the elasticity of the springs that support the car. It is claimed that a car mounted on the truck can round a curve with greatly reduced friction. Owing to the eased wheel base the motor wheels can be located under the ends of the car, thereby obviating rocking motion. It is claimed that a car equipped with the six-wheel radial truck will glide along smoothly over the rails when running at a very high speed.



HIGH SPEED TRUCK.

The fender is provided with a rubber cushion on the front and covered on top with two thicknesses of a heavy felt cloth. The fender projects about four feet from the front of the car and is so connected with the car truck frame and journal boxes and is braced with sufficient rigidity to pick up, it is claimed, a man weighing 250 pounds. The inventor of the truck is Charles Thompson, of Syracuse, New York.

Washington Conduit Railway.

The conduit electric railway of the Metropolitan Railway Company, of Washington, D. C., will be in complete operation by the middle of August. About the first of the month the first cars will be started out and the number will be gradually increased as the men are found ready to take charge of them.

The Sacramento-Folsom Plant.

On July 15 street cars in Sacramento were operated for the first time by current generated at Folsom by the American River Falls, the transmission being accomplished to the satisfaction of all concerned.

The Niagara Falls plant is the only one larger than that in California, and the successful operation of this ambitious enterprise will doubtless give a decided impetus to long-distance electrical transmission.

Street Railway Mail Service in New York.

The postoffice authorities have concluded arrangements with the Third Avenue Railway Company, of New York, by which the latter will carry mail over its lines. The cars will be nine in number, painted white and of a uniform size —22 by 9 feet. They will run as trailers and will be fitted with all the modern appliances now in use in the railway mail service.

The cars will handle mail from eight sub-stations between the main office and sub-station L, at Third Avenue and 125th Street. Besides greatly facilitating the service, the new system will materially reduce the cost of the local transportation of the mails, as fully half of the 200 mail wagons now in use will be dispensed with.

FINANCIAL NOTES.

RICHMOND, IND —The Richmond Street Railway plant was sold to day to satisfy a decree in favor of the Union Trust Company, of St Louis, which held $200,000 worth of bonds. A number of intervening creditors also have claims.

OTTAWA RAILWAY REPORT.—The following figures are taken from the first annual report of the Ottawa (Ont.) Electric Railway Company: Gross revenue, $193 991.36; total expenses, $122,335.67; net receipts, $71,655.69, or about 10.4 per cent. on the average paid-up capital stock During the year dividends aggregating $55,082.32 were paid, leaving the surplus of the year $16.570.37

THE BRADDOCK (PA.) ELECTRIC STREET RAILWAY COMPANY'S Board of Directors has called for the second assessment on the capital stock, and it is proposed to complete the line by Aug. 1. The road was built several years, but it has not been operated for three years because of an injunction secured against it by the Pennsylvania Railway Company on account of the grade crossing at Copeland station.. The railway will be bridged at Copeland, and the line extended to East Pittsburg and westwardly to Wilkinsburg The proposed improvements will cost over $50,000. The line is now four miles long, and the extension will add four more.

CONSOLIDATION RUMORS IN PHILADELPHIA.—The Philadelphia *Times* says: The movement to consolidate the People's and Electric Traction companies, which has been in progress for some time, was formally considered at a conference held between the officials of the two companies yesterday afternoon, though the directors decline to discuss the matter. It was stated before the meeting that an effort would be made to arrive at a basis upon which the amalgamation can be effected, though it will probably be several weeks before the details can be arranged. The officials have admitted that the consummation of the deal is only a matter of limited time, and that it will probably include the Hestonville, Mantua & Fairmount road. The negotiations up to this time have been conducted with great secrecy, and nothing definite can be learned as to the terms upon which it is proposed to settle.

THE BELT RAILWAY COMPANY OWES $101,824 61.—Assistant City Commissioner Charles A. Hook, who was appointed umpire between the referees in a dispute between Baltimore City and the Belt Railway Company over money to be paid for the completion of the North Avenue bridge last week, rendered a decision to the effect that the Belt Railway Company owes the city $101,824.61. In explaining his reasons for arriving at this decision, Mr. Hook reviews the correspondence between Engineer Smith and Chief Engineer Rea, of the Maryland Construction Company, agreeing to certain conditions for constructing the bridge which were to be embodied in the ordinance. Mr. Hook says: "The ordinance does not require the Belt Railway Company to construct approaches, but requires the company, in accordance with an agreement between it, the city commissioner and the water engineer, to pay the sums of $9,000 $3,000 and $92 000. The ordinance also authorizes the mayor and city commissioner to contract with the Belt Railway Company to construct approaches to the bridge substantially in accordance with plans on file in the city commissioner's office." The decision is accepted as final, because the officials of the city and the railway company agreed to submit the dispute to the referees appointed by each side, who were to choose a third man in case they could not agree. The third man was Mr. Hook.

PHILADELPHIA TRACTION COMPANY'S REPORT.—The annual report of the Philadelphia Traction Company for the year ending July 1 has been filed with the Department of Internal Affairs at Harrisburg. It shows that 111,475,982 passengers were carried, and 39,721,208 transfers issued. The most profitable months were October and May, 10,285,527 passengers having been carried in the latter, and 10,009,715 in the former. The passenger receipts aggregated $5,459,867,89 and the total revenues from all sources $5.662,051.11. There was expended in operating the different lines controlled by the company $3,540,839.96, of which $1,350,866.70 was disbursed for the payment of the conductors, drivers, gripmen and motormen. The electrical expense was $414,664.71. The total disbursements are placed at $3.576,522.06, of which $398 694.92 went for the payment of taxes, and $319,262.04 for damages. These items appear under the head of assets: Cash, $415,713.86; stocks, $3,731,940.22; equipment, $2,207.283 47; construction, $10.295,574.59, and open accounts, $5.733.761 35. The liabilities aggregate $22 406,278.49. Dividends of 8 per cent. were declared Dec. 1, 1894, and June 1, 1895, amounting to $1,000,000. The number of miles operated was 203. During the year 3 passengers were killed and 130 injured; 4 employees were killed and 8 injured, and 22 other persons were killed and 112 injured. The amount of capital stock paid in was $15,000,000, the amount subscribed $20,000,000, and the amount authorized $30,000,000. The funded debt was $1,053,000, and the total cash realized from the capital stock $16,053,000. The first class passenger cars number 1,080, and are valued at $1 800 each. There are 348 second-class cars in the service of the company valued at $200 each. The cars are reported to have a seating capacity of from 22 to 32. The number of cars propelled by electricity is 743, and drawn by horses and mules 625. The average rate of speed is put at from six to seven miles an hour. The car houses, shops and stables number 31, and the depots 13.

NEW INCORPORATIONS.

THE ALTON RAILWAY & ILLUMINATING COMPANY, Alton, Ill., has been incorporated by James F. Porter, Charles W. Illner, Henry R. Phinney. Capital stock $250,000.

THE CHICAGO (ILL.) WESTERN ELECTRIC STREET RAILWAY COMPANY has been incorporated by Henry T. Beam, Maier Rosenthal and Harlan W. Cooley. Capital stock $5,000,000.

THE SOUTH FREEPORT & CEDARVILLE ELECTRIC RAILWAY, Freeport Ill., has been incorporated by A. Bergman, Henry Lichtenburger and A. Baumgarthner, with a capital stock of $100,000.

THE EDWARDS AUTOMATIC CAR FENDER COMPANY, capital stock $100,000, has been incorporated in Brooklyn by P. J. Carlin, Henry W. Rozell, James H. Colyer, John Barnes, M. F. McGoldrick and Charles Edwards,

THE FAIRMOUNT (W.VA.) SUBURBAN RAILWAY COMPANY, capital stock $200,000 has been incorporated by N. A. Clayton, W. T. Horton, C. L. Skinner and others, for the operation of street railways on all the streets in Fairmount.

THE ALBANY (N. Y.) & SUBURBAN RAILWAY COMPANY, capital stock $200,000, has been incorporated by R. F. Barnes, John S. Burke, George T. Cunningham, George B. Moore, Arthur Hilton, John Leggett, Albert J. Barnes and others, to construct a road to connect Greenwick, Castleton and Bath-on-the-Hudson with Albany.

THE SANTA BARBARA CONSOLIDATED ELECTRICITY COMPANY, Santa Barbara, Cal., capital stock $200 000, has been incorporated by A. Hope Doly, N. F. Ashton and B. S. Hayne, Santa Barbara, Cal., for the purpose of acquiring, constructing and maintaining street railways in Santa Barbara County, by electricity, cable, gas or water power.

THE PITTSBURG, SHERADEN & CARNEGIE TRACTION COMPANY, Sheraden, Pa., has been incorporated with a capital stock of $42,000, for the purpose of constructing and maintaining an electric railway. The incorporators are Henry J. Wenke, Pittsburg, D. H. Ferrel, Sheraden, Pa ; Harding Kimberland and Miller Elliott, Allegheny, Pa.

THE ARKANSAS CITY & NORTHWESTERN CONSTRUCTION COMPANY, Jersey City, N. J., capital stock $500,000, has been formed to build, maintain and operate railways and steamboat lines, and to construct, develop and promote electric railways. Marion W. Lewis, Boston, Mass.; J. B. Leake, New York, and Geo. L. Dayton, Jersey City, N. J , are the organizers.

THE ELECTRIC TRANSPORTATION COMPANY, capital stock $25,000, has been incorporated at Jersey City, N. J , for the purpose of manufacturing and dealing in electric boats to engage in inland navigation. The promoters are Frank Ribbett, Rahway, N. J.; Samuel D. Colleit, Brooklyn, N. Y ; Edward B. McCleas, George F. Evans and Charles E. Ainsworth, Jersey City, N. J.

THE RADNOR ELECTRIC PASSENGER RAILWAY COMPANY, of Radnor, Pa., has been incorporated to operate four and one-half miles of line in Delaware County over the old Lancaster (Conestoga) road, in Radnor township. The capital stock is $30,000. The directors are Henry Douglass Hughes, Andrew J. Reilly, David Pepper, Jr., T. E. Schermerhorn, Frank H. Hawkins, Lincoln L. Eyre, H. A. Mullen, Philadelphia; Albert Layton Register, Ardmore.

NEWS OF THE WEEK.

BASIC CITY, VA.—A company will be formed to incorporate an electric road from Basic City to Bridgewater.

HOMESTEAD, PA.—The Homestead & Highland Street Railway will extend its line from Homestead to Duquesne.

MIDDLETOWN, CONN.—The directors of the Street Railway Company have voted to construct an extension to Cromwell at once.

HILLSBORO, TEX.—It is reported that Boston parties have secured an interest in the Hillsboro Street Railway, and will make it a trolley line.

PORTSMOUTH, VA.—The Board of Supervisors has granted the Portsmouth Electric Railway Company right of way through additional city streets

BIRMINGHAM, ALA.—An effort is being made to have the Birmingham Railway & Electric Company extend its trolley system to North Birmingham.

BALTIMORE, MD.—The City & Suburban Railway Company has decided to extend its Columbia Avenue line to Lansdowne, in the southwestern suburbs.

KNOXVILLE, TENN.—The West Knoxville Street Railway Company will re-lay several of its lines with 56-pound rails, and a power house will be erected.

WATERLOO, N. Y.—Ground has been broken for the erection of an extensive power house and depot in Waterloo for the Geneva & Cayuga Lake Railway Company.

CHICAGO, ILL.—The Illinois Central is contemplating the use of electricity instead of steam on its suburban lines between Van Buren Street and Grand Crossing.

PITTSBURG, PA.—Superintendent McCoy, of the Birmingham Street Car Company, has stated that work on the extension of the line will be commenced right away.

FAIRMOUNT, W. VA.—A charter has been issued to the Fairmount Suburban Railway Company, giving it the right to construct a street railway in the town of Fairmount.

SYRACUSE, N. Y.—W. B. Cogswells, C. B. Tracy and G. Higgins, are interested in the erection of a new electric railway between Syracuse and Manlius. Capital stock $250 000.

ALBANY, N. Y.—The Albany Railway Company has decided to expend a considerable amount of money in improving its lines. The officials state that about $40,000 have been expended.

NEWBURYPORT, MASS.—The Board of Aldermen has granted the People's Street Railway Company an extension of time in which to build a line through Storey Avenue to West Newbury.

NEW LONDON, CONN.—It is hoped by the street railway company to have a new electric road between New London ready by May 20, 1896. The work of building the road will be begun this fall.

YOUNGSTOWN, O.—The Park & Falls Electric Railway Company has applied to the County Commissioners for franchises for an electric line from the south city limits to Portland and to North Lima.

WESTPORT, CONN.—The Westport & Saugatuck Horse Railway Company has gained legislative authority to increase its capital stock to $100,000, to extend its line and to equip it with electricity.

FORT LEE, N J.—It has been learned from a reliable source, that the Palisades Railway Company is negotiating with the North Hudson County Railway Company to extend its electric road to Coytesville.

COCHRANVILLE, PA —The citizens of Cochranville are unanimous in their opinions that an electric railway from Parksburg to Oxford, via Cochranville and Russellville, would be a good thing for the village.

CAMDEN, N. J.—The City Council has favorably acted upon the petition of the West Jersey Traction Company for permission to lay tracks and operate street railway lines on the various streets in the city.

COLUMBUS, MO.—The City Council has granted Col. E. C. Moore a franchise to construct a street railway from the northern to the southern limits of the city, the same to be operated by either horse or electric power.

PITTSBURG, PA.—The people of Liberty and Finleyville are pushing the scheme for the building of an electric line that shall put them in closer touch with Pittsburg. Judge Walker is one of the projectors.

FAIRFIELD, KY.—About $20,000 has been subscribed toward the stock for building the proposed electric road from Louisville to Fairfield. E. H. Bidwell, of Fairfield, and James McKinney, of Louisville, are interested.

NEWPORT NEWS, VA.—A trolley line has been put down from the Chesapeake & Ohio Railway station to the plant of the Newport News Shipping & Dry Dock Company, and cars will begin running within a day or so.

RIVERHEAD, L. I., N. Y.—A syndicate of New York & Philadelphia capitalists want to construct and operate a trolley road from Riverhead to Orient, passing through the villages of Riverhead, Jamesport, Franklinville, etc.

FREDERICK, MD.—The question of the construction of an electric railway between Frederick and Middletown is revived. The projectors state that prominent farmers in Middletown Valley have taken their full amount of stock.

ORANGE, N. J.—A company has been formed, known as the Freeman Street Improvement Company, to build a trolley line from the Highland Avenue station of the D., L. & W. R. R. over the mountains to St. Claud. President, John Davis.

ORANGE, N. J.—Watson Whittlesey, receiver for the Suburban Traction Company, will make application to the Common Council at its next meeting for a franchise to extend the suburban tracks from Scotland Street to the West Orange line.

PARAGOULD, ARK.—E. M. Harrison, of the Harrison Electric Company, of Chicago, with J. D. Block and others, of Paragould, are promoting an electric line from Siloan Springs, Ark., through Paragould to Gavoso, Mo., on the Mississippi River.

NEW BRITAIN, CONN.—Engineer W. H. Cadwell has been at work for the Central Railway & Electric Company, surveying two routes to Newington from Jubilee Street. The company has a petition in the Common Council for permission to extend its lines to Jubilee Street.

NEW BRIGHTON, S. I., N. Y.—The New Brighton trustees have granted the Staten Island Electric Company permission to lay tracks in the terminal district, which embraces Jersey Street, the Terrace, the Turnpike and connecting streets; also in Brooks Avenue, and the connecting streets of the Clove Road.

WASHINGTON, D. C.—The residents of Silver Spring, Woodside, Linden and Forest Glen have felt the need of additional rapid transit to Washington. Practical steps toward the building of an electric line to connect with Brightwood Road at North Tacoma were taken by a number of property holders at a recent meeting.

YOUNGSTOWN, O.—Youngstown is desirous of being connected with Pittsburg, Pa., by an electric railway. Since the formation of the company to connect the Beaver Valley with Pittsburg, capitalists of Youngstown have been actively engaged organizing a company to build a road from Youngstown to Beaver Falls.

COLUMBIA, PA.—After several weeks' delay, everything is now ready to begin the construction of the Columbia, Ironville & Mt. Joy Electric Railway. The lease which was pending between the two companies, the Columbia & Ironville Company and the Railway Company, has been signed. H. H. Heise and Col. Bratton are interested.

CHESTER, PA.—Surveys for the new branch of the Delaware County & Philadelphia Electric Railway have been completed and specifications will be ready in a few days for contractors to bid on. The branch will start at Baltimore Avenue and Church Lane, just west of Fernwood Cemetery, and run out Church Lane and Marshall Road to the city line at Cobb's Creek.

CHICAGO, ILL.—Mayor Swift will be asked to sign the trolley ordinance, or the Council will pass it over his veto. The Chicago City Railway Company will be ready to begin putting in new rails and stringing wires. It is said that the company is prepared to expend $1,500,000 during the next nine months. In all, some 15 miles of new track will be laid, and ten miles of horse car line relaid with heavier rails and converted into electric lines.

DERRY, N. H.—A meeting of the directors of the Chester & Derry electric railway was recently held, and officers re-elected. Prof. Cassius Campbell was chosen temporary chairman at the meeting. Reports were presented and everything pointed to an early survey and construction of the road. Charles Bartlett, of Derry, and A. H. Wilcomb, of Chester, were chosen as a committee to have a survey of the proposed road made. Estimated cost of road $50,000.

SYRACUSE, N. Y.—The property of the Syracuse Consolidated Railway Company will soon pass into new hands, and there will be a general overhauling of the lines. A franchise was recently granted to the Syracuse Railway Company for the construction of a single track in Park Street, from Wolf Street to the city line. The railway company proposes to make a belt line of the old Woodlawn & Butternut Street line.

NEW HAVEN, CONN.—At a recent meeting of Board of Councilmen the report of the Committee on Railways and Bridges, recommending that permission be granted to the Manufacturers' Street Railway Company to construct and operate by electricity a freight railway through certain sections of Fair Haven, was again discussed. Councilman Scoville offered an amendment providing that the company pay $8,200 for the franchise; this was defeated.

FRANKLIN, MD.—Residents of the vicinity of Franklin and Wetheredville, Baltimore County, will organize a company to build an electric railway from the latter place to a point on Edmondston Avenue, where it will tap the line of the Maryland & Columbia Railway, now in course of construction. J. H. Judik, president of the People's National Bank, has been named for president of the proposed company.

HACKETTSTOWN, N. J.—It is likely that an electric line will be built between Hackettstown and Asbury, Warren County. The civil engineer of the Lehigh Valley Railway, accompanied by Daniel Osman and Mr. Randolph, has gone over the route to get an estimate of the cost of maintaining bridges in various places. The new system will be a great convenience to the citizens of Asbury and Hackettstown.

BUFFALO, N. Y.—Another new trolley line to Tonawanda is projected to run from the city line at Niagara Street to Tonawanda, and its route will be down the River Road, following the bank around the curve opposite the head of Grand Island to its northern terminal at the New York Central station in Tonawanda. It is understood that the persons interested will immediately take steps to secure a franchise from the city for permission to come within the city limits as far as Hertel Avenue.

ILION, N. Y.—The Little Falls Common Council has granted a franchise to the Little Falls Electric Railway Company to build an electric road in that city. The company proposes to extend the road from Little Falls to Richfield Springs The Council has also granted a franchise to the Little Falls & Herkimer Company to have an entrance to the city from the west provided satisfactory arrangements can be made to use the tracks of the Little Falls Electric Railway Company, where the two companies occupy the same streets.

NORRISTOWN, PA.—An answer has been filed by the Norristown & Chestnut Hill Railway Company in the suit brought by Kate Marple, who seeks to compel this company to remove its tracks, wires and poles from the Germantown Turnpike. As a result of an injunction the road has not been in operation since June 3. In its answer the company takes the ground that, inasmuch as the complainant interposed no objection while the road was being constructed or operated, her non-interference is in equity a consent to the construction of the road.

MEDIA, PA.—The Westchester Pike Railway Company is prepared to operate its road either by electricity or by steam. The power house of the company at Llanarch is now about completed, and the road will be ready for operation in a few days. It is blocked, however, by two injunctions. One of these enjoins the erection of trolley wires, and the other enjoins the line crossing the tracks of the Pennsylvania Railway at Llanarch at grade. The company has the right to run the road by steam, and it is believed that an agreement can reached by which the objectors will consent to the erection of the trolley wires.

AUBURN, N. Y.—The Common Council, at a recent session, rejected the $6 000 bond tendered by the local street railway company, on the ground that the bond contained no provision for the sureties on it remaining liable, during the time between the expiration of the two years for which it was made out, and such a date as a new bond for another two years should be granted. However, in order to give the railway people time in which to rectify this error, the Council granted them an extension of time until July 15, at 4 o'clock. In case of failure to comply with this demand the franchise of the street railway shall be revoked.

HARRISBURG, PA.—Applications have been received at the State Department, Harrisburg, from the Pennsylvania Traction Company, for three charters, one for the Philadelphia, Lancaster & Harrisburg Railway Company, with a capital stock of $6,000,000, one for the Lititz & Manheim Railway Company, with a capital stock of $50,000, and the other for the Lancaster, Ephrata & Reading Railway, with a capital stock of $70,000. For the latter two companies the charter members are John J. Patterson, J. Hay Brown, John Skiles, J. Gus Zook, Michael Reilly, Dr. M. L. Herr, Dr. Henry Yeagley and others.

BALTIMORE, MD.—Wm. H Whitridge, President of the South Baltimore Land Company, and J. J. Alexander, his attorney, July 9, filed a petition with the Baltimore County Commissioner at Towson, asking for the privilege of constructing a single or double track railway, from the company's lines to Meeter's pavilion. The proposed railway will begin at a point on Gwynn's Falls, and pass through the property of the South Baltimore Land Company to the Annapolis Road on Maryland Avenue. Dr. Henry J. Hebb, J. Isaac Holbrook and W. Vernon Dorsey were appointed examiners to ascertain whether the public convenience requires the opening of the new road in the second district.

PHILADELPHIA, PA.—The Philadelphia Traction Company has begun an action against the Electric Traction Company, the Lombard & South Streets Passenger Railway Company and the Frankford & Southwark Philadelphia City Passenger Railway Company. On June 19, 1892, the Philadelphia Traction Company, as lessor of the Philadelphia & Gray's Ferry Passenger Railway Company, which was lessor of the Schuylkill River Passenger Railway Company, operated a street railway on 23d Street. The defendants operated a line which crossed the plaintiff's tracks. It is claimed that when the defendants were repairing the crossing they left it in such condition that it caused an accident for which the plaintiff had been compelled to pay $9,500. It seeks to recover this sum.

LOWELL, MASS.—Charles F. Woodward, Daniel G. Walton, and others of Wakefield, have asked the selectmen for a location for an electric road through the town to the Lowell line. The petitioners have subscribed for the stock of a road between Reading and Lowell, by way of Wilmington and Billerica, entering Lowell on the eastern side of the Concord River. The Lowell & Suburban already occupies the road on the west bank of the Concord, with a road to North Billerica, and has a location to Billerica Centre. The new company, it is stated, will ask for a location in Lowell connecting with the Lowell, Lawrence & Haverhill road at Merrimac Square. The stock is subscribed for principally in Wakefield and Reading.

LONG BRANCH, N. J.—At the meeting of the Township Committee of Ocean Township last Wednesday, this body granted the Atlantic Coast Electric Railway Company a franchise to cross the Deal Turnpike, Rosald, Grant and Sherman Avenues at Deal, and to occupy about 800 feet of the old Fresh Pond road at Pleasure Bay after leaving the Dobbins property. This makes the line continuous from Asbury Park to Pleasure Bay. Lawyers for the opposition, the cottagers and hotel men are at work testing every opportunity to thwart the plans of the trolley projectors. The company has a large force of men at work, and expects to have the line in operation by Aug. 15. In the ordinance granting the franchise the company is prohibited from even applying for permission to extend tracks into the aristocratic precincts of Monmouth Beach or Seabright.

PERSONAL.

MR. WM. PIKE, JR., so long connected with The Brady Manufacturing Company, of Brooklyn, and for the last two years as their superintendent, has resigned, and is now taking a much needed rest.

MR. JOHN G. HONECKER, superintendent of the Allentown & Lehigh Valley Traction Company, of Allentown, Pa., has been appointed superintendent of the Citizens' Railway, of Detroit, Mich. His successor is Frank S. Drake, superintendent of the Allentown Electric Light & Power Company, and electrical engineer of the traction company.

TRADE NOTES.

CLUF TYBERG, M E., so long and favorably known as a practical and theoretical designer and the constructor of many automatic and other labor-saving machines, has recently acquired an interest in and accepted the position of superintendent of the Brady Manufacturing Company, of 83 Washington Street, Brooklyn, N. Y., where he will be pleased to serve his friends and patrons.

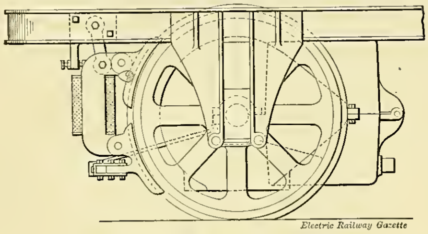
GEORGE C. EWING, formerly superintendent of the Composite Brake Shoe Company, has recently opened an office at 620 Atlantic Avenue, Boston, and will act as New England agent for a number of street railway supply houses. Mr. Ewing will handle only high grade supplies.

THE OHIO BRASS COMPANY, of Mansfield, O., has recently established an Eastern office, 1302 Havemeyer Building, New York, with J. F. Macartney as manager. Mr. Macartney's name is familiar to street railway men. He is known as a thoroughly practical man, and a thorough electrical engineer, as well as a successful salesman. He has recently closed several large contracts for construction material, and reports that the outlook for future business is exceedingly good. The company reports business in a very satisfactory condition, as it has recently secured the following large contracts, besides numerous smaller ones: Benwood & Moundsville Electric Railway Company, Benwood, Va; Austin Dam & Suburban Railway Company, Austin, Tex.; Cincinnati Street Railway Company, Cincinnati, O.; Brunswick Traction Company, New Brunswick, N. J.; Union Railway Company, of New York City; Tonawanda Street Railway Company, North Tonawanda, N. Y.; Lemuel Sorrell, Contractor, New York City, N. Y.; Ogdensburg Street Railway Company, Ogdensburg, N. Y.; The Mahoning Valley Railway Company, Youngstown, O.; London Street Railway Company, London, Can.; Interurban Railway Company, Saginaw, Mich.

Record of Electric Railway Patents.

PATENTS ISSUED JULY 9, 1895.

542,228. TROLLEY BREAKER; Henry P. Ball and Charles A. Lieb, New York, assignors to the General Electric Company, Schenectady, N. Y. Filed Aug. 8, 1894. The trolley breaker or line section insulator consists of metallic end-pieces secured together by a central bar of metal. The bar is insulated from the end-pieces and has an upper and lower bar of wood adapted to act as compression and extension members respectively. Means are provided for permitting the end-pieces to move outwardly on the ends of the extension member and yet retain the latter in place.



NO. 542,309.—ELECTRIC BRAKE.

542,242. CAR FENDER; Robert C. De Vault, Philadelphia, Pa. Filed March 29, 1895. The fender is adapted to fold up upon itself, a guard being pivoted to the fender and also adapted to fold up upon itself. Springs are provided for normally urging and holding the fender outwardly for retaining the guard up against the front of the dashboard. Dogs secure the same in their closed positions, means being provided for releasing them.

542 276. CAR FENDER; Daniel O'Mahoney, Jersey City, N. J. Filed April 4, 1895. A main fender or guard frame which is pivotally connected with hangers supported from the platform and carries at its front end a supplemental guard or fender pivotally connected therewith and adapted to be folded thereon or projected in front thereof. The main frame is also provided with sweepers adapted to move in contact with the track and clean it.

542,303. CAR GUARD OR FENDER; Henry Burden, Troy, N. Y. Filed April 8, 1895. This is a combination with a net for a car guard or fender of a series of elastic tube sections strung upon wires or chains arranged to intersect each other angularly between the tube parts and connected thereat, with a bar at the bottom of the net and a rail at the top.

542,309. ELECTRIC BRAKE; William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed March 20, 1895. This is a combination in a braking apparatus of a brake shoe or similar retarding means with manually actuated means for applying the shoe. The means operate a part only of the shoe, a power actuated mechanism being connected with the entire shoe and applying the whole of it to the wheel. (See Illustration.)

542,310. RAILWAY-CAR WHEEL; Jonas Printz, Omaha, Neb. Filed March 2, 1895. The wheels are provided with outwardly extending friction flanges which are scalloped. A two-part rail comprises a main supporting section in combination with a friction rail, transversely in the shape of an isosceles triangle, the parts of the friction rail being positioned vertically and being reversibly and adjustably secured to the main part of the rail. The angular sides of the friction rail are adapted to engage the friction flanges of the wheel in order to support them.

542,414. BRAKE-SHOE; John J. Kinzer Jr., Pittsburg, Pa. Filed May 9, 1895. The patent covers a composition for brake-shoes consisting of comminuted iron, asbestos, plumbago, resin and linseed oil.

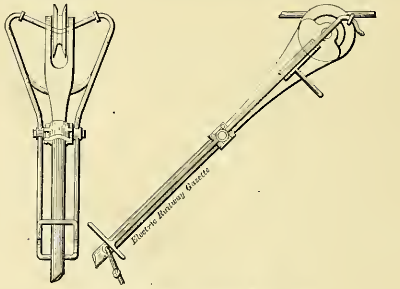
542,434. UNDERGROUND TROLLEY; Leedham Binns, Philadelphia, Pa. Filed April 11, 1894. The trolley comprises a frame adapted to be pivoted to the car, a head being secured in the free end of the frame. A trolley pulley is journaled in a frame attached to the head, chains being connected with the head and extending in opposite directions under the car. Means are provided for winding or unwinding the chains to impart an upward or downward swinging motion to the frame.

542,480 CAR-FENDER; Joseph Leightham, Reading, Pa., assignor of one half to William H. Slichter, same place. Filed March 21, 1894. The car is provided with vertical supporting plates extending up in front of the dash and below it and provided with rear extensions secured to the platform timbers. The upper ends of the beams are formed so that the fender may be hinged removably thereto. Swinging guides with springs for the lower part of the fender are carried by supports beneath the plane of the platform.

542,481 CAR-FENDER; Joseph Leightham, Reading Pa., assignor of one half to William H. Slichter, same place. Filed April 8, 1895. The fender extends up in front of the dash and downwardly and forwardly below the dash, expansive springs being interposed between the car and the lower part of the fender. Arms extend forwardly from the car and to them the fender is pivoted at its sides above the planes of the springs and a distance below its upper ends. The fender has a limited longitudinal movement in addition to its wing.

542,512. ELECTRIC RAILWAY SYSTEM; Robert B. Wilson, Cincinnati, O., assignor of one half to Jeremiah M. Wilson, Washington, D. C. Filed Jan. 2, 1894. A main lead conductor and a sectional conductor are provided, each section of the latter having its own connection with the former. The connection is normally open and disconnected from the lead conductor, but is adapted to be closed by a current from a preceding section, and thereafter be kept closed by a current through itself direct to the return, separate and independent of any other connection.

542,539. APPARATUS FOR REMOVING OBSTRUCTIONS FROM CAR TRACKS; Frank Shuman, Philadelphia, Pa. Filed Nov. 14, 1894. The patent covers a method of preventing accidents or of removing bodies in the path of cars The method consists in using a source of gaseous fluid supply under pressure, means being provided for projecting a blast or blasts of such fluid forwardly in advance of the front wheels of the car, and at such an angle to the track as will cause the body to be carried forward in advance of the wheels.



NO. 542,591.—TROLLEY FINDER.

542,573. ROTARY FENDER FOR RAILWAY CARS; John H. Shoenberger, Philadelphia, Pa. Filed Aug. 29, 1894. The fender combines a rotative brush or sweeper, a vertically movable support for the spindle of the brush, a catch for retaining the support in an elevated position, a trip plate in advance of the fender for releasing the catch, rotating mechanism for the fender and means for throwing a clutch into or out of action on the descent or rise of the movable brush support.

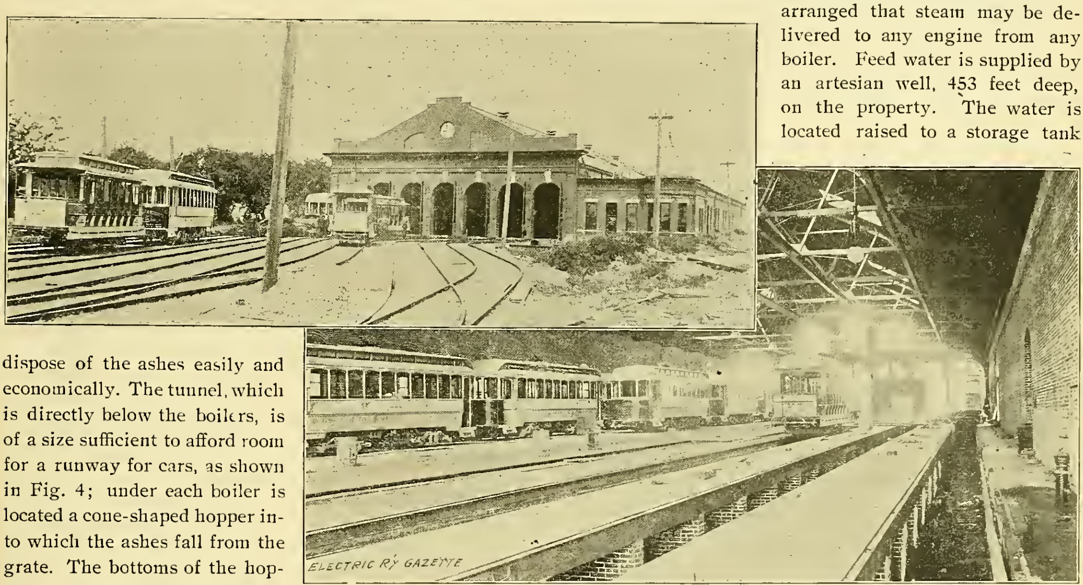
542,591. TROLLEY FINDER; Charles C. Lynde, Buffalo, N. Y. Filed Nov. 28, 1894. The trolley guide consists of a frame centrally pivoted to the trolley-pole, its lower portion having a loop encircling the trolley-pole to limit its swinging movement. Its upper swinging portion has a cross-piece adapted to have contact with the lower side of the trolley-wire. (See Illustration.)

Electric Railway Gazette.

Vol. XIII. NEW YORK, JULY 27, 1895. No. 4.

New Jersey Electric Railway Company.—II.

The boiler equipment at the present time consists of three 350-hp Morrin Climax boilers built by the Clonbrock Steam Boiler Works, of Brooklyn. A view of the boiler room is shown in Fig. 3. Adequate provision has been made for increasing the steam generating plant, as the demand on the station increases, and the room is sufficient for the installation of boilers of an aggregate capacity of 5,000 hp. The foundations for the boilers are so built as to form a tunnel, the boilers resting on "I" beams which have been let into the side wall. This arrangement makes it possible to dispose of the ashes easily and economically. The tunnel, which is directly below the boilers, is of a size sufficient to afford room for a runway for cars, as shown in Fig. 4; under each boiler is located a cone-shaped hopper into which the ashes fall from the grate. The bottoms of the hoppers are provided with gates, so that the ashes may be dropped directly into the cars which then run by gravity to the dumping ground near the building. The boilers are provided with McClave shaking grates which were designed especially for this type of firebox in use. Each boiler has a separate steel stack.



FIGS. 1 AND 2.—INTERIOR AND EXTERIOR OF CAR HOUSE.

The facilities for receiving coal are excellent. The company will build a dock on its property to which coal may be brought in boats, and a complete system of coal handling machinery will be installed. Steel coal bunkers of 3,000 tons storage capacity will be located over the boilers and coal will be delivered by chutes to each of the four furnaces.

The steam piping system possesses several interesting and novel features and is so arranged that the danger of a complete shut-down because of an accident to the piping is reduced to a minimum. The steam pipes from the boilers are eight inches in diameter and lead to a 12-inch main. Steam is taken from this main by and delivered to the engines through seven-inch pipes, which are connected to the upper side of the main by elbows and extend down the wall, passing under the engine room floor through a separator to the engines. By this arrangement any water in the steam main is prevented from passing into the engine supply pipes, as would be the case if they were connected to the lower side of the main.

The steam supply pipe for the condensers and pumps is joined to the lower side of the main, and is provided at the elbow with a drip and steam trap. A permanent iron gallery is located just below the steam main and is reached by permanent iron ladders, so that in case of accident the valves may be reached without delay. The valves are so arranged that steam may be delivered to any engine from any boiler. Feed water is supplied by an artesian well, 453 feet deep, on the property. The water is located raised to a storage tank of 100,000 gallons capacity by the Pohle air-lift system. The air compressor and receiver are shown at the left, in Fig. 3. In addition to supplying the feed water the compressor also furnishes compressed air for cleaning the electric generators. For this purpose a pipe extends from the condenser under the engine room floor to a point in the engine room near the generators, where it is connected to a flexible hose. The feed pumps are of the Worthington duplex type and the plant is also provided with a Stratton separator and a 1,000-hp Goubert heater. The condensers are of the Worthington independent type and their connections are so arranged that any engine can be run on any condenser or two engines on one condenser. They are connected in such a way that while the engines are running on one condenser the other may be employed to deliver water to the car house on the same property, for cleaning cars or in case of fire.

The arrangement of the steam and condenser piping is such that the engines may be run with either high or low-pressure cylinders, either simple high-pressure or high-pressure condensing. The condensers are equipped with 14-inch Blake automatic relief valves. The pipe from the relief valve, instead of being carried up through the roof, as in the ordinary construction, is dropped four feet and is carried to the rear of the building. By this construction, if the condenser should lose its water the exhaust from the engine will pass directly to the atmosphere, and in case the exhaust pipe should fill with water the relief valve will be lifted and the water will be discharged through the same pipe. The condensing water, which is taken from the Hackensack River, flows by gravity through a ditch to a tank eight feet in diameter and fifteen feet deep, located in the rear of the building. The ditch is provided with a tide gate which is closed when the tide begins to recede, thus retaining the water in the ditch. The arrangement of the condensing system is admirable, and is such that the danger of a complete shut-down is practically eliminated. The feed pumps are fitted with eight feed lubricators for delivering crude petroleum to the boilers for preventing the formation of scale.

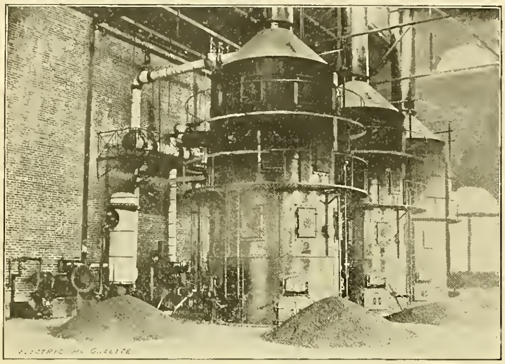


FIG. 3.—BOILER ROOM.

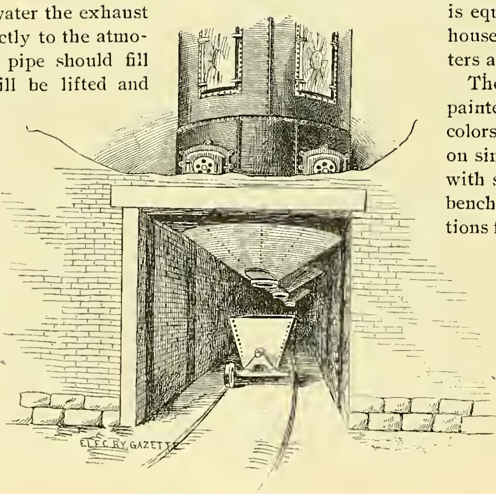


FIG. 4.—ASH TUNNEL UNDER BOILERS.

The car house, Figs. 1 and 2, is located on the same plot of ground as that on which the power house has been erected. The building measures 280 by 60 feet, and is constructed of brick, and has a galvanized iron roof supported by steel trusses furnished by the Pennsylvania Steel Company. The building will also contain the machine shop, blacksmith, paint and carpenter shops, and an armature winding room.

The superintendent's office is located in this building and in the arrangement of the structure a desirable provision has been made for the comfort of the employees. The waiting rooms are large, well lighted and well ventilated.

The car house is provided with seven tracks, three of which are equipped with pits extending the whole length of the building. The entire space between the pit tracks is left open and the tracks are supported by brick cross walls into which are sprung concrete arches covered with Portland cement. The tracks are so laid that a grade of 1 per cent. is formed, the tracks extending beyond the building to a distance sufficient to accommodate as many cars as are contained on the tracks in the building. By this arrangement, in the case of fire, the cars can be quickly run out of the building by gravity.

Traveling cranes are located over each pit, so that the car bodies can be quickly and easily moved to any part of the building. The several repair shops will be fully equipped with the most modern appliances for making all necessary repairs, and will have independent tracks extending into each department.

The cars operated on the road were supplied by the St. Louis Car Company and the J. G. Brill Company, of Philadelphia, and are mounted on trucks of the same manufacture. The closed cars, Fig. 5, are provided with vestibules and are 40 feet in length over all. They are mounted on double trucks and are very handsomely painted and decorated, the exteriors are finished in cream color, with red dashboards, and are lettered and ornamented in gold. The interiors are finished in cherry, with bird's-eye maple ceilings, and are lighted by ten incandescent lamps. Each car is equipped with two 30-hp Westinghouse motors. New Haven fare registers are used.

The summer cars, Fig. 6, are painted and decorated in the same colors as the closed cars and are mounted on single trucks. They are provided with six reversible and four stationary benches, and have seating accommodations for 50 passengers. They are provided with spring roller curtains and the interior finish is similar to that of the closed cars. The motors are of the Westinghouse type and the cars are equipped with Field fenders. The track construction throughout the line is of a very substantial character; nine-inch 90-pound girder rails are employed in the city. They are spiked to 6 by 8 in. oak ties on braced tie plates. The greater portion of the track in the suburban districts is laid with 70-pound T rails. The rails were furnished by the Pennsylvania Steel Company, and Wm. Wharton, Jr., & Co. In the city, iron

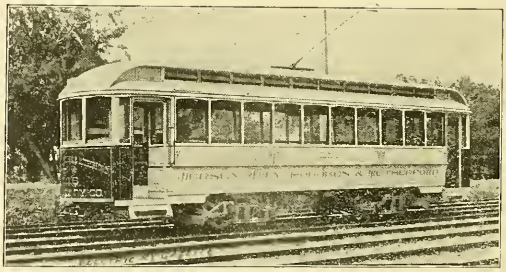


FIG. 5—CLOSED CAR.

side poles are employed, and on the suburban lines octagonal wooden poles have been set. The road crosses the Hackensack River, near the power house, over a double-track trestle bridge 1,000 feet long, built by the company.

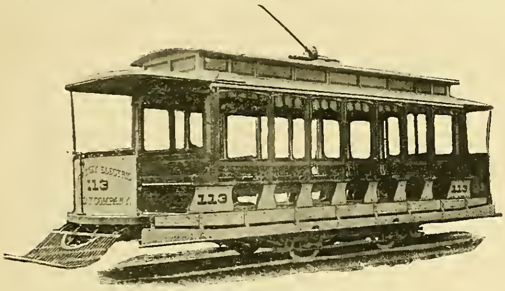


FIG. 6.—SUMMER CAR.

(*To be continued.*)

International Railway Congress in London.

[From Our London Correspondent.]

Over 1,000 delegates, representing railway interests in all parts of the world, attended the International Railway Congress in London during the latter part of June and the first few days of July. The Prince of Wales made an address on opening the proceedings, and in the course of his remarks referred to electrical traction, which he considered would "present a field for their inquiries, as yet comparatively unexplored." He also thought the delegates would be able to give important and useful information upon the question of light railways which had been so much before the British Government—both in the House and in committee—during the past few months.

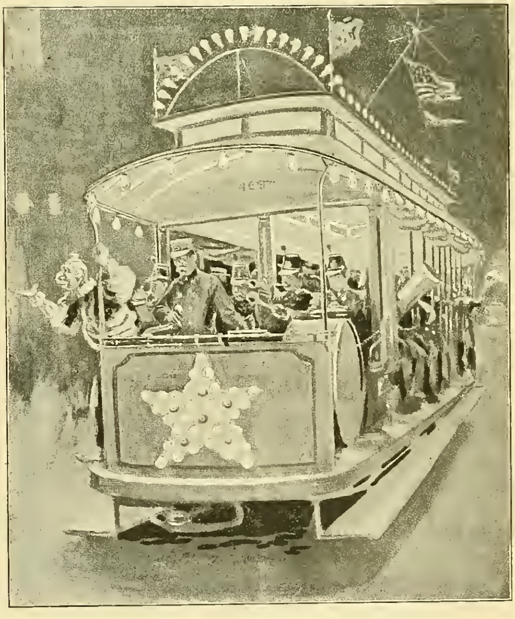
There were few papers dealing with electricity, the greater proportion being devoted to the traffic and general management of railways. A report was presented (for non-English speaking countries) by Messrs. Eug. Sartiaux and A. Von Boschau, on the employment of mechanical and electrical appliances in shunting.

The lighting of trains was discussed, several representatives detailing experiments they had made with electric lighting.

A paper on electric traction was contributed by M. Auvert, engineer in the Central Rolling Stock Department of the Paris & Lyons Railway. He said the application of electricity to the propulsion of tram cars was now well established, at all events in America, where this mode of traction was gradually supplanting all others. On the other hand, electricity as applied to railway traction was only met with in exceptional cases, on short lines, laid under special conditions. The two things could not, of course, be discussed on the same footing. In the majority of cases the numerous lines of a tramway system, being laid for the purpose of connecting different points of a limited district, were grouped in such a manner that the distance, as the crow flies, between the extreme points of the system, was not very great. On the other hand, railways, being laid for the purpose of connecting points separated by long distances, had these extreme points considerably more remote, and when it was a question of a line of great length, as was the case on a great number of railways, the first cost per mile of the conductors became very great, and it would hardly be advisable to reduce the section of the distributing conductors by having recourse to high-tension currents, on account of the dangers presented under these conditions. On railways it was only possible in very exceptional cases to employ self-contained carriages, and the use of locomotives was, therefore, essential. The problem then which had to be solved was the replacement of steam locomotives by electric locomotives, and it was in the construction of these locomotives that nearly the whole of the difficulty of the application of electricity to railway purposes rested.

Philadelphia Trolley Parties.

Descriptions of the elaborately decorated cars, which are put at the disposal of trolley parties in Philadelphia, have, from time to time, appeared in these columns, and an illustration of one of these, reproduced from *Leslie's Weekly*, is presented herewith. The people of Philadelphia are now in the throes of a "trolley" excitement which is peculiar to that city, says that paper. It takes the form of long evening rides to the suburbs, where, in various resorts, they regale themselves according to need and inclination. Usually parties of friends (or it may be a regular social club or lodge) make necessary arrangements with the trolley companies, and at the appointed rendezvous board the handsomely-appointed and extravagantly-illuminated *private* cars and proceed to the destination selected. Some of the outings take on the character of masquerades, which with the bands of music, afford considerable entertainment and amusement to the residents and sight-seers who throng the thoroughfares over which the excursionists pass. In many places Chinese lanterns and bunting assist in lending a carnival aspect to the occasion. On one route as many as 70 or 80 parties are out every evening.



DECORATED CAR FOR TROLLEY PARTIES.

The cost of these trips is inconsiderable. While the charge varies according to route, $10 per car per night is about the average. This makes the expense per capita very light. The craze commenced last summer, but bids fair to reach greater proportions this year than ever before.

Decisions Favorable to Philadelphia Companies in Fender Suits.

Magistrate Jermon, of Philadelphia, before whom were tried last week the suits against the Philadelphia Traction Company and the Manayunk & Roxborough Inclined Plane Electric Railway Company to recover penalties for alleged failure to comply with the provisions of the local fender ordinance has decided in favor of the defendants. The city will appeal from the finding of the court. Magistrate Jermon, in introducing the cases submitted to him, says, in his opinion: "These suits before me are not brought to recover a debt, but to enforce a penalty for an alleged violation of the law. The cases are essentially of a criminal nature, and not of a civil kind, hence it is my duty to carefully consider the ordinance under which they are instituted, and to deal with it as though it were a criminal statute. There must, under well-established principles, be a strict construction. No matter what the necessity may be for protection to life and limb against accidents in the running of trolley cars; no matter how great the demand for improved guards or fenders, nor how much it might be my desire, personally, to compel the adoption of safeguards which would aid in the preserving of life and limb, as a magistrate I cannot consider these things, but must lay them aside, and deal solely with the legal proposition: Does the ordinance in question describe some act or neglect, denounce it as an offence, and punish it with the penalty of a fine? And does the evidence submitted to me show that the defendants have committed the offence in question? If both parts of this question shall be answered affirmatively, then my judgment must be against the defendants, but if either is answered in the negative, then my judgment must be for the defendants. The ordinance in question is as follows:

" 'An ordinance requiring passenger railway companies propelling their cars by electricity to provide the same with suitable fenders for the protection of life and limb.

" 'Section 1. The Select and Common Councils of the city of Philadelphia do ordain: That within ninety (90) days after the passage of this ordinance, it shall be unlawful for any passenger railway company propelling its cars by electricity to run the same through the streets or avenues of the city, unless each car is provided with a safety guard or fender, constructed in such a way as to protect life and limb of any person who may come in contact with said car. In case of the neglect or refusal of any company to comply with the requirements of this ordinance within the specified time they shall be subject to a fine of not less than ten dollars per day for each day that said car may be run. And if the violation shall continue after a period of thirty days shall have elapsed, an additional penalty of forty dollars per car per day shall be imposed; and it shall be the duty of the Department of Public Safety to see that the provisions of this ordinance are strictly enforced. The penalties provided for to be collected as like penalties are now by law collectible. Approved the twenty-seventh day of March, A. D. 1895.'

"The language of this ordinance is ambiguous. So defective is it that one might be justified in believing that it was not only an error, but perhaps intended to be defective, and passed to defeat the very object which it contemplated securing. 'Within 90 days after the passage of this ordinance it shall be unlawful for any passenger railway company propelling its cars by electricity to run the same through the streets and avenues of the city unless each car is provided with a safety guard or fender, constructed in such a way as to protect life and limb of any person who may come in contact with said car.' Clearly this legislation only covers a period of 90 days, and has no operation beyond that time. Doubtless the thought was to give a period of 90 days to the railway corporations for preparation, after which, if they ran their cars without guards or fenders, they would incur the penalty. But the law does not say this, and I know of no power by which I, as a magistrate, am permitted to reform an ordinance and attempt to write into it what I may believe may have been the intent of the law-making body, when the language expressly contradicts such an intent. Without doing violence to the plain language of the ordinance, I cannot construe it to mean anything else than a prohibition of certain things for a period of 90 days.

"If the ordinance so construed be ridiculous, it is the fault of those who framed it. While pointing out this defect in the language of the ordinance, which in my judgment is a fatal one, I am not obliged to decide these cases on this ground, but have considered other branches which lead to the same result. The requirement of the ordinance is that a 'safety guard or fender' shall be provided for every car. The ordinance does not attempt to describe or require any particular kind, nor regulate where it shall be placed, so that the railway companies are left to select between a guard or fender and to locate the same wherever it may seem best in their judgment to place them. The proof before me established that either a guard or fender was placed in front of every car or in front of the first set of wheels. Of course, in any case where this is not so the company is liable to the fine. The only provision that may be regarded as a regulation is the following: 'constructed in such a way as to protect life and limb of any person who may come in contact with said car.' This requirement is so general and indefinite that it ought scarcely to be made the basis of a quasi criminal proceeding. But giving this language its full force and considering the evidence, the mind is forced to the result that there has been a reasonable compliance on the part of these defendants to the ordinance above mentioned. The expert witness for the city admitted on cross examination that he could not name any device that would certainly protect life or limb under such circumstances. Hence, the compliance with this clause must ever be a matter of good judgment.

"In suits such as these before me, the basis of which is neglect, and the judgment in which is intended to punish a neglect, it must appear that there has been clearly established a neglect to comply with the provisions of the ordinance. Therefore, if one charged with the duty of providing these appliances, in good faith and in the exercise of his best judgment, places guards or fenders designed to protect life or limb upon their cars, then, in the absence of any well-known and certain device, he cannot be said to have neglected to comply with the requirements of the ordinance. In these cases, from actual experience, persons testified that the devices in use not only were intended to protect life and limb, but had actually realized that result in the instances named. How, then, can it be said, in a legal sense, that these defendants have neglected to comply with this ordinance?

"The great difficulty arises from the fact that there does not appear to be any well-defined consensus of opinion in favor of any particular device to be used as a guard or fender. In the present uncertainty and in the absence of specific requirements in the ordinance, I am of opinion that the defendants have reasonably endeavored to comply with the terms of the ordinance. I am unable to say that they have neglected or refused to comply therewith. It is within the province of councils to define not only the kind of device to be used, whether guard or fender, or both, but to designate where it shall be placed on the car. It is only reasonable that they should do so before the city proceeds by suit to collect penalties for violation of the ordinance on the ground that, in the judgment of some of the officials, the kind adopted do not sufficiently protect life and limb.

"A quasi criminal suit for penalties cannot rest on such a basis. My judgment in these cases is in favor of the defendants for the reasons above named."

Taxation of Franchises.

At a recent meeting of the city board of tax equalization in Minneapolis Assessor Plummer presented an opinion to the effect that franchises were taxable. In reference to the local street railway company this statement was made: "The Minneapolis Street Railway Company in this matter may stand in a somewhat different relation than the other companies. In the case of all others the city has been generous, not a dollar having been paid by them for the valuable rights and privileges which have been granted them, but in the case of the street railway company, for the right to operate their cars upon our streets, the city, as it had a right to do, has imposed a license of $25 per car. I claim that this does not affect the right or the duty of the assessor to recognize the franchise. I am of the opinion, however, that in consequence of this license the company is entitled to especial consideration at our hands, for the following reasons; They have given us what is perhaps the finest street-car service in the country. The expenditure of large sums of money in changing their system and extending their lines aided very materially in preventing widespread distress among our laboring population during a period of extreme business depression. In matters pertaining to this department, I am pleased to say, in justice to them, that they have been fair. It is true, the city has been liberal with them, as well as with the other companies. It is also true that they have maintained faith with the city on all occasions."

Philadelphia Transfer System.

The several street railway companies of Philadelphia have been holding conferences for the purpose of taking concerted action in reference to the existing transfer system. It has been found that the present generous plan of issuing transfer slips has been abused to a considerable extent. It is stated that within the last year about 80,000,000 transfers have been issued. Recently the practice of trading or selling transfers has become so common that the necessity of introducing restricting changes has been apparent.

Syracuse Consolidated to Be Sold.

Sheriff Austin, of Onondago County, has been appointed referee to sell the property of the Consolidated Street Railway Company, of Syracuse, which is now in the hands of receivers. The decree for the foreclosure was granted in a suit brought by the Central Trust Company, of New York.

Some Practical Hints for Motormen.—IX.

BY GEORGE T. HANCHETT.

Practical Construction of Armatures.

For a practical article such as this aims to be, the amount of theory and diagrammatic figures has perhaps been a little tedious to the motorman, who desires to know how his motor is put together. The next few sections will be devoted to this, and it is hoped will be of interest.

The armature, it will be remembered, is simply a lammelar (that is sub-divided) mass of iron, cylindrical in form and carrying on its curved surfaces conducting wires or bars parallel to the axis of rotation. The conductors are connected together in various ways, according to the ideas of the designer, and these methods of connection we have recently discussed. For convenience in discussion, the following terms are used: A conductor is a single wire, bar, or number of wires wound as one, on the *curved surface* of the armature. A connector is that portion which connects two conductors. A loop or coil is the amount of wire between adjacent commutator bars. Now, while it is very easy to draw a straight line connecting two conductors, either opposite or on the quarter, the wire which that straight line represents does not always find so easy and direct a path.

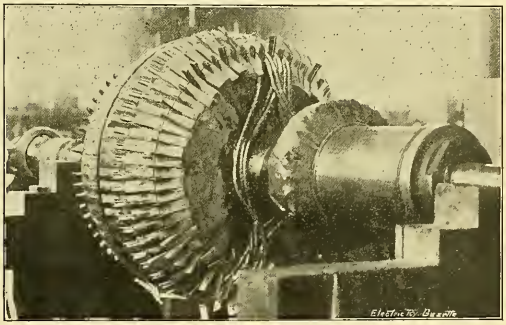
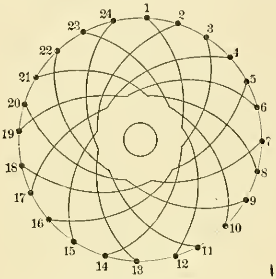


FIG. 25.

True, the first wire can be strung as the crow flies, and the second and third also, but when the tenth, twelfth and perhaps the one hundred and sixtieth wire connects the opposite conductors together, there is usually a pile of wire to run over which is unsightly and often unsymmetrical. Fig. 25 shows an armature used for lighting that is partially wound. This shows how the wire tends to pile up over the ends. The first armatures for lighting and power purposes were made in this way, and when the demand for railway armatures arose, it was met for a long time with this class of winding. The great object seemed to be to connect across the head somehow, and the head of the railway, or indeed, any armature of the drum type, appeared to be a hopeless maze of wire, even for the simplest windings.

These armatures, when used for railway purposes, were usually covered with canvas at these overlapping heads. This kept the dirt out, but it also kept the heat in, and the head of the armature was usually the source of any trouble that arose. Moreover, it was as unsightly as a bag of potatoes revolved on an axis, and beside thus distressing the mechanical eye, it was actually a mechanical detriment, as it required to be balanced in order to insure quiet running. In order to obtain a good mechanical balance, a great many devices were tried, both in regard to the order of winding on the coils and the actual path which the coils were to take. This resulted in a much more symmetrical head on the armatures, and when covered with canvas, presented a far neater mechanical job. Still, a serious defect existed. The armature, however perfectly balanced, was out of *electrical balance*. That is, some of the coils being obliged to lap over others, were longer than them, and hence had a higher resistance. Now, while the extra resistance of a few inches of wire is very small, it usually is a large percentage of the resistance of a coil, and is, therefore, a serious matter, as we shall see in another chapter. When the brushes are set correctly to commutate a coil of a certain resistance, they are incorrectly set to commutate a coil of any other resistance. Hence, a commutator on one of these unsymmetrical armatures is liable to a certain amount of incurable sparking and heating.

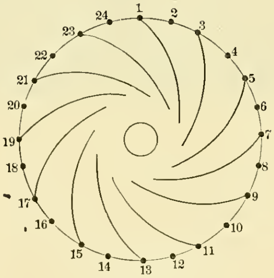


END CONNECTORS

Electric Railway Gazette

FIG. 26.

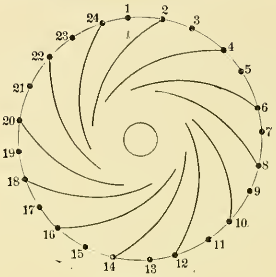
The problem of how to make an armature winding that shall not only have coils of the same resistance, but the same shape and size as well, has been successfully met by several designers. Many have partially, and a few wholly, met this requirement. Now consult Fig. 26. It is natural to suppose that it is proper to connect each conductor on to its opposite. However, this is the very thing that we must not do. Every conductor on the one side of the armature needs a return on the other side. Hence, we may not connect No. 1 on to No. 13, but on to No. 14 or No. 12, according as we desire on right or left handed winding. Now, if we separate Fig. 26 into two figures, drawing only one half of the armature connections across the ends in each diagram, we see that in each of the two diagrams, Figs. 27 and 28, there are *no cross wires*. But taken together, there are many crossed wires. Now, if we so wind the wire as to have all of the uncrossed wires of each diagram come in *separate layers*, we need to have the armature head only two layers thick, and the wires not objectionably crossed. This method is very often practiced, as it affords a perfect electrical and mechanical balance, and forms a very compact armature.



OUTER LAYER

FIG. 27.

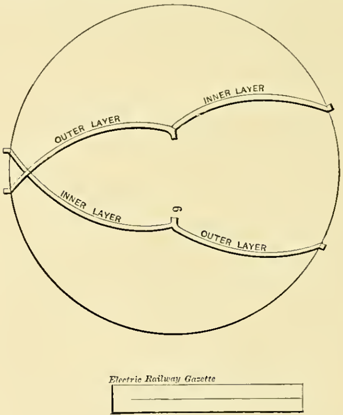
In order to have all of the coils exactly the same in shape and resistance, it is evident that the connectors of any loop must be partly on the outer and partly on the inner layer on the head of the armature, for if any one of the coils has a portion of its circuit in these positions, all of the coils must be similarly arranged. Let us assume, in the Figs. 27 and 28, that the halves of connectors of Fig. 27 form the outer layer, and that those of Fig. 28 form the inner layer. Then the wires or conductors with the odd numbers must project further beyond the iron of the armature by the thickness of one connector. Fig. 29 shows how this is arranged.



INNER LAYER

FIG. 28.

Following the connector down till it gets half way across the head, we come to a point *b*, where the wire must turn it and become an inner connector. At this point in practical armatures, there is usually very little room, and hence the wire must turn sharply in parallel to the shaft, and continue on the inner layer up to its proper conductor. In practical armatures, these connectors are usually made of thin ribbons of copper, set with their width parallel to the shaft. Even then the connectors have to take a spiral path, and not a straight line, in order to make room for them all.



Electric Railway Gazette

UNBENT CONDUCTOR

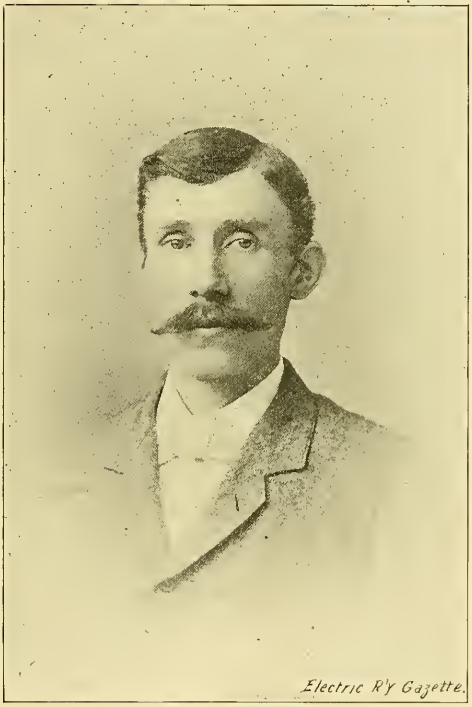
FIG. 29.

(*To be continued.*)

Street Railway Engineers.—XIII.

AXEL H. ENGSTROM.

Mr. Axel H. Engstrom, of the electrical and mechanical engineering department of the Electric Traction Company, of Philadelphia, has had charge of a great deal of interesting electric railway work in that city during the last two years. He is an engineer of extended practical experience and ability. He was graduated from the Royal Technical High School, of Stockholm, Sweden, and subsequently learned the trade of machinist at Kockhum's Marine Engine Works, at Malmo, Sweden. He came to this country in 1881, and was engaged by William Sellers & Co., of Philadelphia, Pa. He remained in their employ as machinist for a period of three years, and then accepted a position as draughtsman and engineer with Stanley S. Flagg & Co., of Philadelphia. Subsequently he accepted a proposition from the Detroit Electrical Works, of Detroit, Mich., and served the company as chief draughtsman and engineer until it suspended. A little more than two years ago he was engaged to take charge of planning and constructing power houses, machine shops and car barns for the Electric Traction Company, of Philadelphia, and he has remained in the service of that company since that time. Readers of the Electric Railway Gazette must have gained something of an idea of the character of Mr. Engstrom's work in Philadelphia from the descriptive articles which have appeared from time to time in these pages. Within the last few weeks the Delaware Avenue and the South Street power stations in Philadelphia, both of which were planned and constructed under the supervision of Mr. Engstrom, have been described and illustrated. These plants are in every sense modern, and in their construction many new ideas have been introduced, which it is believed will add to their economical operation.


Electric R'y Gazette.

AXEL H. ENGSTROM

Boston, London and German Railways.

Gisbert Kapp recently read, before the Electro-Technical Society, of Cologne, Germany, a paper in which he drew a comparison between the street railway systems of London and Boston. Though the former city covers about ten times the area of the latter, he said, the length of lines in the two is nearly identical, Boston having about 270 miles of line, and London about 20 miles less. The number of car-miles run in Boston is 18,750,000, and in London about 21,870,000 miles. But though the density of traffic is thus greater in London than in Boston, the latter makes much more satisfactory returns to its shareholders, the averaged dividend there being 9 per cent. on a capital account, some 25 per cent. more than in London, where, nevertheless, the shareholders have to be content with but 3⅓ per cent., or so, on their capital, which, moreover, from the recent decisions of the courts, appears to have been staked on a very precarious security. The working expenses of the two lines are practically identical, but in Boston they only amount to 68 per cent. of the receipts in place of 82.7 per cent. as in London. The Boston lines are, it should be added, worked on the trolley system, while, with the exception of a small proportion of cable line, the London tramways are operated entirely by horses. Mr. Kapp states that in Germany there are now some 212 miles of line worked electrically, the rolling stock consisting of 540 motor cars and 420 ordinary ones. An additional 112 miles of line are, moreover, now in course of construction, and will find employment for 290 motor cars. Some of these lines have very heavy grades; in particular, there is one in Barmen where an incline of 1 in 5 is surmounted, a rack rail being used, as the adhesion is, of course, insufficient. Nevertheless, quite steep slopes are worked without calling in the aid of such special devices, there being a slope of 10 per cent. on the Remscheid line. The ratios of expenses to receipts on these lines are put at an extraordinary low figure, as little as 13.4 per cent. in some cases. In certain of the smaller plants the sudden and great variations in the demand for current have proved troublesome, and have led to the use of accumulators as regulators. At Hirslanden, near Zurich, for instance, the plant includes two 90-hp engines, one of which is used as a stand-by. There is also a battery of accumulators, consisting of 300 elements, which in normal work can supply a current of 81 amperes. The current on the line ranges, with the nine cars in use, from 50 to 110 amperes, but occasionally reaches as much as 200 amperes. Automatic apparatus reaches as much as 200 amperes.

Consolidated Company of Pittsburg.

The Consolidated Traction Company of Pittsburg, into which the principal street railways of that city are to be merged, has been incorporated. The capital stock is given in the charter as $150,000, which, it is taken for granted, will be increased to a figure somewhere between $10,000,000 and $20,000,000. The stock is divided into 300 shares, of a par value of $50 per share. The shareholders are C. L. Magee, George W. Elkins, William Flinn, George Sheppard and John M. McBride. They are all directors of the company, except Mr. McBride. C. L. Magee holds 150 shares as trustee, and George I. Whitney 30 shares as trustee. Each of the six has 20 shares besides. The company is chartered for 99 years.

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SUBSTITUTION OF ELECTRICITY FOR STEAM.

It is a surprising fact that the topic of electric traction attracted so little attention at the recent International Railway Congress in London. The efforts which are being made in many quarters to substitute the electric motor for the steam locomotive form a topic, it seems to us, of paramount importance at the present time in the transportation world. The little which was said appears to have little significance. Our London correspondent, who summarizes the only electrical paper of consequence, quotes its author as saying that the problem to be solved was the substitution of electric locomotives for steam locomotives, and that it was in the construction of the former that "nearly the whole of the difficulty of the application of electricity to railway purposes rested." This statement we are at loss to understand. We can build electric locomotives or motor cars of the desired capacity and speed. The only difficulty lies in the distribution of the power. With that problem solved there can be no serious obstacle in the direction of applying electricity on a much larger scale for railway purposes.

STREET RAILWAY CONSOLIDATION.

At the present time there exists a pronounced tendency in the direction of street railway consolidation in large cities. A notable instance is to be found in Kansas City, where the local street railway interests were recently united; a similar project has been practically effected in Pittsburg; persistent rumors of combinations in Baltimore and a part of Chicago are in circulation, but by far the most significant enterprise of this sort yet undertaken is the consolidation project that seems to be about accomplished in Philadelphia. If the deal in that city is perfected, and there seems to be every reason to believe that no obstacle will arise to prevent the success of the undertaking, it will be the greatest enterprise of the kind yet attempted in the street railway field. The union will be one of corporations into which were merged, some time ago, 30 or more companies which were formerly in control of the horse railways. The capitalization of the three companies which it is proposed to unite is $45,000,000 and of this amount over $11,000,000 has been actually paid in, while the funded debt and the assumed indebtedness reach about $14,000,000. It is difficult to state at the present time the exact mileage which is to pass under the control of the consolidated company, as all the existing corporations have been building extensions of late, but it is safe to assume that it will not be less than 360 miles. It is doubtless a fact that the public is inclined to regard consolidations of this kind with suspicion as monopolies inimical to its interests, but this view does not seem to obtain favor in Philadelphia, so far as we are able to ascertain. One of the most conservative of the local papers says that "there is no reason to fear that consolidation of the several traction companies will lead to a curtailment of privileges, an increase in the cost of travel, or inferior service. On the contrary, they may, judging by previous experience, look for better service and such a readjustment of transfers and exchange privileges as will, in the end, give greater advantages than the few exceptional favors now enjoyed under the stimulus of competition." Another Philadelphia paper remarks that "some such consolidation has been recognized as inevitable, and it seems to have come about through the natural development of business, and while it is designed in the interest of the shareholders, there is no reason why it should not prove advantageous to the public." The great motive which has inspired the leading spirits in the companies to form a union of interests was their wish to reduce expenses and put a stop to profitless competition. With the three properties under the control of a single organization, the cost of management can be very materially lessened. At the same time the distribution of power in the vast territory covered by the existing lines can be effected far more economically. The practice of extending lines before they are required by public convenience, in order that territory may not be seized by a rival, can now be safely abandoned. It will be possible to arrange the service in accordance with the requirements of the public and the interests of the shareholders without reference to matters of policy which it has been heretofore necessary to keep constantly in view on account of the increasing bitter competition. For these and other reasons, it is probable that substantial economies will be effected, but at the same time the character of the service will be in no respect impaired, for the experience of the companies in Philadelphia since the introduction of the electric system has been such as to convince them of the financial advantage attending a liberal treatment of the public.

FENDER SUITS IN PHILADELPHIA.

The decision of the Philadelphia court in the local fender cases was to be expected. The position of the companies, against which suits were brought to recover fines for their alleged failure to conform to the municipal ordinance providing for the equipment of cars with life guards, was sustained in every respect. The opinion of the court is interesting, and we devote to it a generous amount of space elsewhere in this issue. In the first place, the court discovered a technical defect in the ordinance, which would have necessitated the defeat of the prosecution, regardless of the merits of the case. The court finds that the measure was drawn up so loosely that it is ludicrous as a legal enactment. From the language employed, a meaning may be drawn exactly contrary to that which it was intended to convey. While the proceeding might have been dismissed, because of this technical defect, the court decided to consider the suits somewhat on their merits. Here, again, difficulties in the way of visiting penalties on the companies were encountered. The court could not discover that there existed any consensus of opinion as to what constituted a fender. The fact that the defendants placed certain devices on their cars was proof of an intention to comply with the law, even if the appliances did not meet the approval of the municipal authorities. "It is," says the court, "within the province of councils to define not only the kind of device to be used, whether guard or fender, or both, but to designate where it shall be placed on the car. It is only reasonable that they should do so before the city proceeds by suit to collect penalties for violation of the ordinance on the ground that, in the judgment of some of the officials, the kind adopted do not sufficiently protect life and limb." This seems to be common sense as well as law. Let the lawmakers determine what a fender is before establishing penalties because cars are not equipped.

Electric Traction Wanted in Norway.

Einar Rasmussen, of Christiania, an electrical engineer in the service of the Norwegian government, reached New York a few days ago and proposes, during the next few months, to investigate the matter of the electrical transmission of power in the United States. The government, which owns almost all the railways in Norway, wants to determine to what extent it will prove advantageous to operate them by electricity. An abundance of water power is available for the generation of electricity, but in some instances it would be necessary to transmit the current for considerable distances. If any plan for the electrical operation of roads is adopted it will involve the use of water power almost entirely, because one of the chief reasons which prompts the government to consider the question of making the change is a desire to escape the necessity of procuring coal. The country, while rich in water power, is entirely without coal mines and the supply must be imported. At the time of the great coal strike in England, the supply in Norway ran so low at one time that it was questioned if it would not be necessary to discontinue, to a very considerable extent, the railway service of the country. The government hopes to be able by utilizing water power to escape such a predicament. The entire dependence on foreign supply which now exists is not flattering to the national pride. Mr. Rasmussen will probably visit all the large stations in the country where current is carried at high potentials.

Safety of Children.

The supreme court of New Jersey has handed down an interesting decision relating to responsibility of companies for the safety of children entering their cars. The suit was that of the New Jersey Traction Company vs. Danbech. It appeared that a boy 10 years of age was called into a car by a conductor to buy for him a paper of cigarettes. While on the front platform, the former was thrown therefrom by the carelessness of the driver. The company contended that the act of the conductor was purely personal and that he had no authority to invite persons to come upon the cars except passengers. The court pointed out that this is the case of a child and not of an adult and that it might be unreasonable to apply the same rule to a child under similar circumstances. Very few of the rules governing the conduct of a man can be applied to the intercourse with children who must be protected against their own indiscretions. The court held that it was the plain duty of street railway companies to prevent children from entering their cars except under proper safeguards, and if this duty be neglected they become responsible for the consequences.

Probable Consolidation in Philadelphia.

It is not improbable that a consolidation of Philadelphia street railways, of which there have been rumors during the last year, will shortly take place. Leading stockholders of the three traction companies—the Philadelphia, People's and Electric—have been holding conferences the last week to decide upon a plan for uniting the interests of the three great corporations, and they have authorized the publication of some of the points on which they have reached an agreement. It is stated that the plan contemplates the organization of a new company with a capital stock of $30,000,000 to acquire the three properties. What the name of the company will be cannot be stated. It is asserted that it has not been decided whether the stock of the three companies will be absorbed or whether they will be controlled by lease.

According to report, the Hestonville, Mantua & Fairmount Passenger Railway Company, controlling the lines on Arch, Rice and Vine streets, has not been, thus far, included in the arrangements. It is known that overtures have been made to the Hestonville management, but they were not accepted, though it is considered more than probable that the company will find it to its interests to join with the consolidated companies.

A great deal of detail work remains to be done before the plan can be carried into practical effect. The agreement must be endorsed by the boards of directors; contracts must be prepared and signed; the new company formed and the plan underwritten, for it is understood shareholders of the companies involved will be allowed to subscribe to the stock and bonds of the new company.

The three great companies interested in the proposed consolidation are capitalized as follows:

	Capital authorized.	Capital issued.
Philadelphia Traction Company	$30,000,000	$20,000,000
Electric Traction Company	15,000,000	8,750,000
People's Traction Company	10,000,000	6,000,000
Totals	$55,000,000	$34,750,000

The paid-up capital of the subsidiary companies aggregates $10,433.49.

The only item that can be classed as funded debt of the People's Traction Company is an issue of $5,538,000 of trust certificates. The funded debt of the Electric Traction Company aggregates $301,110. The funded debt of the Philadelphia Traction Company is $1,089,000, and that of the subsidiary companies which it leases is $5,488,500.

An officer of one of the interested companies is quoted as referring as follows to the benefit likely to follow consolidation: "It means a cut in expenditures in every direction —from abolishing several separate costly managements, to a cessation of legal proceedings, which have cost the companies thousands of dollars a year. It means there will no longer be a fight to control councils. It will enable a saving on every contract placed, for cars, electrical equipment, coal, street paving, etc. It will put an end to the competition by which the companies lost a million or more a year. It will prevent the construction of lines wholly for competitive purposes."

It has been subsequently announced that the consolidated company will be known as the Union Traction Company. The Electric Traction and People's Traction companies, according to the report, are to be actually consolidated, and the Philadelphia Traction Company will be acquired by lease. It is stated that John Lowber Welsh is to be the president of the new company, and that the board of directors will be composed of five of the old directors from the Philadelphia Traction Company and three each from the other two companies, as follows: From the Philadelphia Traction Company, P. A. B. Widener, William L. Elkins, Thomas Dolan, James McManes and George D. Widener; Electric Traction Company, Jeremiah J. Sullivan, Alexander Fox and Alfred Smith; People's Traction Company, William H. Shelmerdine, John Lowber Welsh and Caleb J. Fox.

The following data of the several lines are of interest. Philadelphia Traction Company: Length of system, 181 miles; passengers carried last year, 102,142,479; gross receipts last year, about $5,000,000. People's Traction Company: Length of system, 48 miles; passengers carried last year, 28,722,705; gross receipts last year, $1,208,807. Electric Traction Company: Length of system, 129 miles; passengers carried last year, 41,040,348; receipts last year, $1,900,606.

Economy of Conductors Used in Transmission of Current for Electric Railways.

Edward P. Burch, electrical engineer of the Twin City Rapid Transit Company, of Minneapolis and St. Paul, recently delivered a lecture before the Society of Engineers, at the University of Minnesota, on the "Economy of Conductors Used in the Transmission of Currents for Electric Railways." The address was, to a very considerable extent, mathematical, and treated the subject in considerable detail. A summary is presented herewith:

In all the principal cities of the United States there are large electric railway systems. These systems consist of power houses in which electric generators, driven by steam engines or turbines, furnish current at from 500 to 600 volts potential to a number of overhead or underground insulated copper feeders, which in turn supply current to insulated trolley line sections. From the trolley the current passes through the motors to the rails. The greater part of the current follows the track to a point near the power station, whence conductors, commonly old rails, carry it to the negative dynamo bus bar. The proper size of these feeders and of the conductors for the return circuit is of importance, both from an engineering and from a financial standpoint.

On account of the heavy currents used in electric railway work, the conductors are large. The heating effect of the current and the power wasted in the conductor varies inversely with the area. The first cost of the conductor varies directly as its area. If we use small wires they will heat, and too much energy will be lost in the transmission. On the other hand, if we install conductors which are too large, the interest on the money invested will be too great. Evidently, the expenditure for maintaining power to overcome the resistance of the line, and the expenditure for first cost, follow opposite laws. *

Between extremes, there must be an economical area—an area such that the sum of the cost of power wasted and the interest on the investment will be a minimum.

The author then proceeded to demonstrate, mathematically, Kelvin's law: "The most economical area is that for which the annual cost of the energy lost just equals the annual interest on the capital invested," and deduced a formula representing that law, from which he noted that the economical area is independent of the length of the circuit and of the voltage employed.

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* Kapp, 4th edition, p. 372.

In order to illustrate the application of this formula, he assumed that the current delivered at the receiving end of the circuit is constant, the rate of interest and depreciation, 6 per cent.; cost of energy at the power house, $87.60 per electrical horse-power per annum, and cost of conductor, 13 cents per pound, under which conditions he found that 6,900 circular mils per ampere must be provided, in order to work at greatest economy. Attention was called to the fact that the equation expressing Kelvin's law is not applicable to cases of power transmission (owing to the extreme fluctuations in the flow of energy), and Mr. Burch stated that the lack of this knowledge had led to some absurd engineering, especially so in low potential transmissions over very great distances.

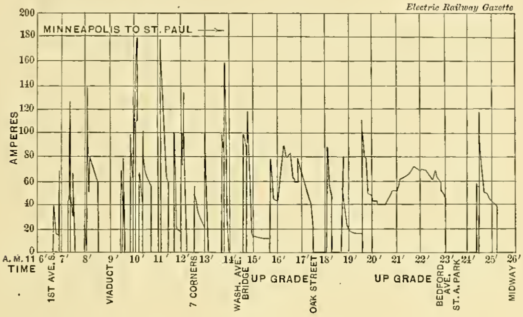


FIG. 1.

In the transmission of power to distant motors, he continued, where the power house potential is a fixed quantity, the current transmitted and the resistance of the line are dependent variables. In other words, if the motors under our electric trains or elsewhere are to do the work at a certain rate, the current delivered will depend upon the motor potential; and the motor potential depends upon the resistance of the line. If the resistance of the line is high, the current used by the motors will actually be greater than if the resistance of the line was less.

It may be suggested that this is peculiar, since it is well known that, in the series-wound railway motors, the running current is entirely independent of the motor potential. But the fact is, if the motors are to be worked at a certain rate and the motor potential is lower in one case than in another, the current must be held on the motors longer, *i. e.*, the motors must be worked harder, must stop and start quicker, run faster and "coast" less, or, if this is impossible, more trains must be put on in order to give the same passenger service. The result in any case of lower motor potential due to increased line resistance is that the total current going from the power house is increased.

The author then submitted an equation in which the variable current and distance are taken into consideration, and a table showing the difference between the economical area obtained from the Kelvin's law formula and that given by this latter equation, for different current values and distances.

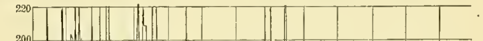
Knowing the economical "copper" area of the conductors, he said, when the length of the circuit is given, we are at once able to figure the economical resistance of the total circuit. If the resistance of the track return is given, or fixed, and thus cannot be decreased, we are able by simple subtraction to state the economical resistance and area of the copper feeders forming half of the circuit. Often the economical resistance of the track is so much lower than it need be that the size of the copper feeders may be made very small.

Length of circuit in feet.	Current in amperes.	Loss on line. Per cent.	Area according to Kelvin's law.	Area from corrected equation.	Add to correct first equation. Per cent.
1	50 00011	......	345,200	345 200	......
1,000	50 11463	227	345,990	346.915	.26
10,000	51.14625	2.24	353.370	362.725	2.64
100,000	61.17550	10.83	422,355	530,225	25.53

Suppose for a moment that after all our calculations, we determine the economical amount and size of our copper feeders and of our return circuit—if the conductors are not distributed to the best advantage there is evidently a waste of money and power.

Perhaps 95 per cent. of the street railway systems of the United States use the same general wiring scheme. Feeders run somewhat radially from the power house to distant sections, as, for example, in Minneapolis to the University Line, First Avenue Line, Hennepin Avenue, The Loop, etc. The city is divided into lines or sections and the feeders, trolleys and mains of one section are thoroughly insulated from each and every other section, so that trouble on one cannot "tie-up" others.

Nearly two years ago a new feeder plan was put in service in Minneapolis and St. Paul; a method of connecting street railway feeders, which may be of interest, as an account of it has not been published. We believe that it is not in service in any other street railway system It has been called a jumper system. It consists of connecting the sections to each other through No. 12 copper wire fuses in such a way that the load on the feeders and sections is equalized and the feeders made to help each other and pull together.



FIGS. 2 and 3.

When the trolleys on different sections are "jumpered," the fuse is simply connected round the circuit breaker. Feeders running parallel to each other, but feeding different sections, are connected, *i. e.*, jumpered by means of fuses which are placed where the feeders diverge, or as far from the power house as possible. The 65 feeder sections and the three power houses of Minneapolis and St. Paul, are thus connected and pull together. In case of the wire being down or other trouble, the jumpers, or equalizers, simply blow and the section is cleared.

The advantages of this system are:

First. It avoids the great fluctuation of load on any one feeder. This is clearly shown by comparing Figs. 2 and 3, where a Hennepin Avenue feeder, No. 14, running from power house No. 1, is shown in Fig. 2 working on the unjumpered plan, and in figure working jumpered to other feeders and sections. As a result of great steadiness of the current in each feeder, the line potential changes slowly. It is noticed at once that the lights in the cars give a very steady light. Each feeder being in parallel with others, the current is much more economically distributed.

Second. The total current at the power house varies less, since the power houses, now in parallel circuit with each other, work together and divide the fluctuation of load. We are thus able to work with fewer reserve units, and work machinery more economically, and more nearly up to capacity, saving in friction, fuel, labor, repairs and general efficiency.

Third. Trouble at the switchboard is greatly decreased. There are no heavy pulls and consequent blowing of the automatic circuit breakers, due to fluctuations on any one feeder. This is a matter of great importance.

Fourth. The power houses being jumpered through feeders as well as connected by the rails, points between have much less drop jumpered than unjumpered, because each power house supplies part of the current and thus the area of the conductor is practically increased.

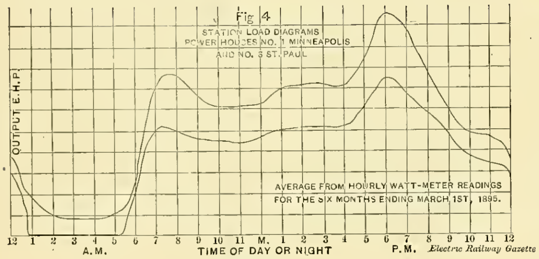


FIG. 4.

In general, feeder loads are equalized—made more steady, and the drop and loss on the line is greatly decreased. Copper is so worked that a feeder which is too large helps one which is too small and the current is distributed more advantageously. Again, the feeder current can be measured with a Weston ammeter without trouble. Frequent tests during the year give us the percentage of the total output which goes through each feeder. The station wattmeters give the total output. Readings are taken every hour from which the switchboard operators plot curves showing the daily, weekly and monthly load diagrams.

The form of these curves for one of the Minneapolis and the St. Paul station is given in Fig. 4. The power house load is not steady as shown, but is continually fluctuating, the fluctuating for full loads being 30 per cent. on either side of the average. During the lights after midnight a large part of the load is the running of motors which drive arc dynamos, and all power houses in the two cities, except one, are shut down. This gives a very small variation of load during the night. Other load diagrams show the variation for the days of the week, and, during the different months, the effect of the weather, darkness, the opera, travel to summer resorts, etc.

In many cases we are called upon to make estimates for new feeder lines and extensions, and to look ahead and figure on expected growth of business. Experience and a study of this complicated problem always point to a very conservative estimate, for we know that the interest on the investment grows at all hours, 365 days in the year, whether expected increased travel materializes or not. Business may change rapidly in a city or in one part of it, so that lines may require changing or a new power house may be necessary. Important changes may affect the system, *e. g.*, the series-parallel controller has saved 20 per ct. of our fuel bills; the now common use of 600 volts, in place of 500 volt power house potential; the introduction of the jumper system of distribution and the use of heavy short rail bonds, all decrease the line loss, the output and the cost of power. Then there is the possibility of cheap water power, improvement in stokers, and fuel oil burning devices, which may decrease the cost of power faster than business may increase. Competition and adverse municipal legislation may change the conditions of economy. In general, a corporation should be conservative, and invest in conductors only when they are necessary for actual economy of operation. Wild guesses and the use of tables showing the "proper size for a given loss" may be avoided by studying the general subject of the economical area and the economical loss, and by collecting data on current strength and the exact value of the constants used in Kelvin's formulæ.

Comments and Views of Contemporaries.

Results of Transfer Systems.—The lessons that the companies have had during the last year of the business to be gained by liberality are not likely to be lost upon the broad-minded managers who have made daily studies of the reports of traffic. They know exactly the currents of travel, and the effect upon these currents of certain attractions and of different weather conditions. It is their business to study and meet the wants of the public, for it is by doing so that they earn dividends for their stockholders. They are not in the business as philanthropists; neither, on the other hand, so blindly selfish as to kill the goose that lays the golden egg.—*Philadelphia Public Ledger.*

Repair of Pavements.—The revolution in passenger traffic effected by the electric motor is scarcely greater than the accompanying revolution in the city streets. The railway companies, as a part of the price of their valuable franchises, have given Philadelphia miles upon miles of improved pavements, incomparably superior to anything known here before or to anything it would have been possible for the city to do for itself in a much longer time, and they are under obligation to keep these pavements in repair. But that obligation relates to the ordinary wear and tear of the streets; it cannot be stretched to cover the destruction of the pavements by other corporations or individuals or by the act of the city itself.—*Philadelphia Times.*

Underground Railways.—In the matter of providing the greatest good for the greatest number, the American people are in the habit of considering themselves considerably ahead of the older nations, and with justice. There are, however, certain matters in which we are lamentably behind, and one of them is the operation of underground railways in very large cities. Such a system ought to be recognized as the most practical solution of the street railway problem. The elevated railway is a monstrous and uncomfortable evasion, and although it has had, in New York, the kind of success which any safe and quick means of transportation would have had in a city so densely populated, it is universally admitted to be a detriment to the appearance of the city and to be only tolerable because, for the time being, it offered the speediest means of intramural transit. The objections which have been raised in the large American cities to underground railways have been the expense of construction, the inconvenience involved to the public during construction and the alleged unattractiveness of the whole system. All these objections can only have been advanced by people who know nothing of the working of the great underground railways of London.—*St. Paul Pioneer Press.*

Boilers and Boiler Specifications.

One of the interesting papers at the meeting of the Northwestern Electrical Association, in Chicago, last week, was read by John C. McMynn, on the topic "Boilers, and Suggestions for Boiler Specifications." He gave the following example of the economy introduced in a plant by improving the boiler and engine:

"The usual amount of steam used in a simple non-condensing engine was 30 pounds per horse-power-hour. In one case improvements were made, and a compound condensing engine installed, and the consumption was reduced to about 18 pounds per horse-power-hour. Before the new engine was installed 100 hp took 3,000 pounds of water per hour, and the average cost of this was, as is the case in the average Chicago plant, sixty cents (60 cts.) per hour for 100 hp. When the compound condensing engine was used the cost of 100 hp was thirty-six cents (36 cts.) per hour. In another plant improvements were made which reduced the cost of evaporating water from twenty cents (20 cts.) per 1,000 pounds to eight cents (8 cts.) per hour; which saving can be made with a much less investment than if new engines should be installed."

Mr. McMynn said he was friendly to the horizontal tubular boiler, but he did not care to be understood as favoring that type rather than a water-tube boiler. The author took up the matter of specifications for boilers, going into considerable detail and making suggestions of practical value.

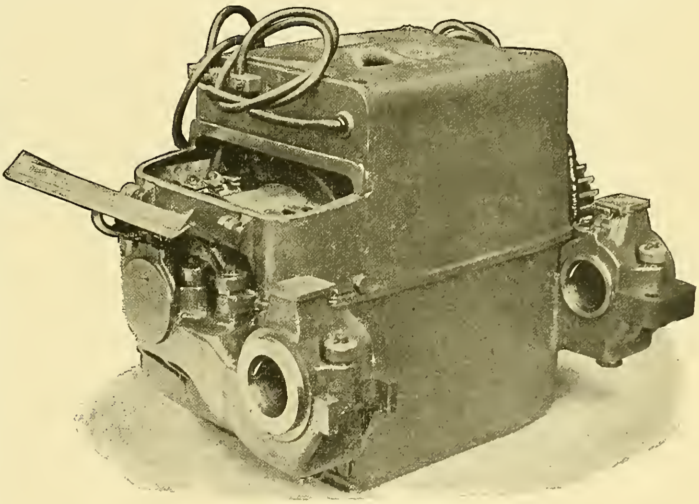
Heating Tests.

The McGuire Manufacturing Company of Chicago furnishes the following figures, showing the results of a comparative test of heaters on cars of the Chicago City Railway Company. The coal stoves were the Columbian magazine heaters, manufactured by the McGuire Company. During the winter, 76 motor cars, with anthracite coal stoves, and 10 motor cars, with two types of electric heaters, were operated. The cars were 21 feet long with no vestibule. The back and front doors were opened occasionally in actual service. Tests were made for heating cars to 35 degrees F. above outside temperature. The hard coal delivered to barns cost $5.35 per ton. The stove consumed one and two-third pounds per hour. The coal delivered at power station cost $1.40 per ton. The electric heaters consumed 6.2 amperes. The figures are as follows:

	Electric Heaters.	Hard Coal Stove.
Estimated interest at 6 per cent, electric heaters at $50 and stoves at $25	.0082	.0041
Estimated depreciation, 10 per cent. electric heaters and 20 per cent. stoves	.0137	.0137
Repairs and care	.0020	.0067
Cost power or fuel consumption	.9360	.0803
Total cost per car per day of 18 hours	.9599	.1048

New General Electric Motor.

The adaptation of electricity to elevated and steam railway traction and the increase in suburban traffic has necessitated the use of motors of a heavier and more powerful type than that ordinarily used in street railway service. To meet the demand created by this need, the General Electric Company has recently designed two sizes, known, respectively, as the G. E. 1,200 and G. E. 2,000. These have already been long enough in service to show that they meet the requirements of the heavier service in a most satisfactory manner. The G. E 2,000 motor, shown in our illustration, is designed for a draw bar pull of 2,000 pounds when mounted on 33-inch wheels, and derives its name from that fact. Complete, with gear case, it measures only 40 inches in width, and is therefore adapted to use on standard gauge axles. For its power its weight, 4,300 pounds, is comparatively light. The armature is of the "barrel" type, a method of constructing which allows of the ready repair of a damaged conductor. The iron-clad construction of the armature, so conspicuously successful in the well-known G. E. 800, is followed. The G. E. 2,000 motor is now operating successfully the cars of the Metropolitan West Side Road recently opened in Chicago. It is also used upon the cars which run on the Nantasket Beach division of the N. Y., N. H. & H. Ry. The G. E. 2,000 finds a field also in driving heavy mining machinery and numerous hoists and pumps scattered throughout the country.



NEW RAILWAY MOTOR.

FINANCIAL NOTES.

ASSETS OF LEWIS & FOWLER GIRDER RAIL COMPANY.—Daniel F. Lewis, representing the Lewis & Fowler Girder Rail Company, recently petitioned the Brooklyn Board of Assessors for a reduction in the amount of the assessment which was placed by the board at $20,000. Mr. Lewis contended that the company had no personality to assess. In his contention he presented a balance sheet. From the assets as shown, April 30, 1895, of $368,091, Mr. Lewis deducted in this balance sheet $153,500 for valueless patents; $100,000 for treasury stock, and $89,600 for bills receivable. There were other smaller charges against the assets which made a small deficit.

LONG ISLAND TRACTION REORGANIZATION.—The plan of the Long Island Traction Company stockholders' committee for reorganizing that corporation seems to have met with the approval of so large a proportion of the stockholders as to almost certainly assure its ultimate success. The capital stock of the Traction Company is $30,000,000 Certificates of stock representing $28,200 000 of that amount have been deposited with the Central Trust Company of New York, together with the first subscription of $5 a share. The remaining 18,000 shares of stock are, according to the statements made by members of the reorganization committee, principally in the hands of people who are abroad or out of town, and will be deposited later.

BINGHAMTON RAILWAY COMPANY.—The annual report of G. T. Rogers, president of the Binghamton (N. Y.) Railway Company, for the year ending July 1, 1895, is very favorable. The president says: "Since submitting my last annual report, issued July 1, 1894, the road has shown the remarkable gain in gross earnings of 17 per cent., and a gain in net earnings from operation, including taxes, of 23 per cent. The percentage of operating expenses to earnings for the past year was 57 5-6 per cent. These results have been accomplished with the same trackage, under the same conditions and in the face of the prevailing financial depression and the most severe winter the road ever experienced. After paying interest on funded debt amounting to $31,500, there remains a dividend upon the capital stock of over 5 per cent. This amount in our surplus account, taken together with the 20 per cent. in stock dividends declared during the past five years of the present management, should prove satisfactory to the stockholders." The receipts for 1895 were $127,483; the operating expenses, $73,716. Net earnings, $50,519; for 1894 the receipts were $108,710; operating expenses $64,677; net earnings, $41,261.

ELECTRIC RAILWAY CONSOLIDATION IN CHICAGO.—There is a good deal of activity in the affairs of electric railways in the Calumet district of Chicago, and a consolidation or change in ownership of those lines is not at all improbable. There are likely to be a number of important extensions also. The Calumet Electric Street Railway is a company with a capital of $500,000 and an authorized bond issue of $3,000,000, of which $2,500,000 have been sold. That company now proposes some further extensions. The South Chicago City Railway Company, of which Columbus R. Cummings is the controlling spirit, has a capital of $1,200,000, and has a like amount of bonds outstanding. Mr. Cummings has been making an effort to secure control of the Calumet electric, but has so far been unsuccessful. An entirely new element in the situation is to be found in a group of people heavily interested in the South Side Rapid Transit who would like to get control of the various electric roads south of that property and operate them as feeders for the elevated railway, says the Chicago *Tribune*. That plan has not been matured, but there have been a number of informal meetings for its consideration, and it is quite probable that something may be done in that direction.

NEW INCORPORATIONS.

THE PONTIAC TRANSIT COMPANY, Pontiac, Ill., has been incorporated by C. C. Strawn, I. F. Funk and L. S. Strawn, to construct a street railway. Capital stock $100 000.

THE WADSWORTH ELECTRIC RAILWAY COMPANY, Wadsworth, Ohio, has been incorporated by W. A. Ault, M. C. Lythle, O. B. Dibble, J. S. Oberholtzer, F. C. Lee and F B. McCauley.

THE KANE STREET RAILWAY COMPANY, Kane, Pa., has been incorporated to build an electric railway. The promoters are C. H. Kemp, Thos. L. Kane and W. P. Weston. Capital stock $6,000.

PITTSBURG, KAN.—The Kansas & Missouri Electric Railway Company has been chartered for the purpose of constructing a railway line in Crawford County. Samuel Barrett and Robert Bobbin, of this place, are interested.

THE GEAUGA CENTRAL RAPID TRANSIT COMPANY, Burton, O., has been formed for the purpose of constructing an electric railway, by P. W. Parmele, George H. Ford, William S. Williams, P. T. Thompson, J. J. Ross and E M. Yeomans. Capital stock $10,000.

THE BEACON LAMP COMPANY, Portland, Me., has been incorporated with a capital stock of $500,000 by Chas. Shoninger, Tabian Sachs and Leopold Toosbach, New York, and Isaac Weil, Boston, Mass., for the purpose of manufacturing and dealing in electric and other machines.

THE EASTON POWER COMPANY, Jersey City, N. J., has been incorporated with a capital stock of $100,000 to manufacture and sell electrical machinery and appliances. Among the incorporators are Howard Lacy, Albert B. Carter, Thos. A. H. Hay, William O. Hay, Asa W. Dickinson.

THE BULLARD ELECTRIC COMPANY, Chicago, Ill., capital stock $25,000 has been incorporated to manufacture, buy, sell and deal in electrical apparatus, machinery, supplies and fixtures of all kinds. The promoters are Charles W. Bullard, Auburt S. Bullard and Carl E. Kammeyer.

THE GREENWICH & SCHUYLERVILLE ELECTRIC RAILWAY, of Greenwich, N. Y., has been formed with a capital stock of $200,000, to build and operate an electric railway. Martin Schenck, Troy; Jas. Mealey, Schuylerville; A. M. Crandall, Middle Falls, and Robert Hamilton, Greenwich, N. Y., are the incorporators.

THE CAPE MAY COURT HOUSE, LIGHT, HEAT & POWER COMPANY, Cape May Court House, N. J., capital stock $25,000, has been incorporated for the purpose of manufacturing, generating and dealing in electricity. Among those interested in the project are Alex. R. Springer, Howard Buckoell and Walter W. Hartel.

THE ALBANY (N. Y.) & SUBURBAN RAILWAY COMPANY, capital stock $200,000, has been incorporated by R. F. Barnes, John S. Burke, George T. Cunningham, George B. Moore, Arthur Hilton, John Leggett, Albert J. Barnes and others, to construct a road to connect Greenwick, Castleton and Bath-on-the-Hudson with Albany.

THE NORTHWEST CONSTRUCTION COMPANY, Portland, Ore, has been incorporated for the purpose of constructing and equipping railroads, electric car lines and motor roads and for doing a general construction business. The promoters are T. H. Curtis, George Taylor, Jr., and F. R. Strong, Portland, Ore. Capital stock $1,000,000.

CITIZENS' ELECTRIC COMPANY, Plainfield, N. J., has been formed for the purpose of building, operating and maintaining electric machinery, implements, appurtenances and plants for distributing light, heat and power. Those interested are Harry G. Runkle, Elias R. Pope, James C. Pope, Plainfield, N. J. Capital stock $1,000,000.

THE WEBBER BRAKE COMPANY, Jersey City, N. J., and New York City, N. Y., capital stock $50,000, has been formed to manufacture, buy and sell railway supplies for the construction and equipment of electric railways. Among the incorporators are George O. Lord, Clifton, N. Y.; Frederick S. Greene, Bayonne, N. J., and Otto R. Saint, New York.

THE SOUTHERN ELECTRIC CONSTRUCTION COMPANY, capital stock $25,000, has been incorporated at Richmond, Va., with J M. Cullingworth, president; C. F. Wingo, vice-president; G. S. Maxwell, secretary and treasurer, for the purpose of constructing and equipping telephone plants and exchanges, electric light plants, and do a general electric business.

IDEAL ELECTRIC CORPORATION, Camden, N. J., and Philadelphia, Pa., has been incorporated with a capital stock of $100,000 to manufacture, install and maintain electrical apparatus. Among the promoters are George L. Colgate, Fanwood, N. J.; James D. McIntosh, Franklin, N. J.; George S. Loutey, William C. Toplin and James Collius Jones, Philadelphia, Pa.

GRAND BOULEVARD STREET RAILWAY COMPANY, 1942 North 17th Street, Philadelphia, Pa., capital stock $50,000, has been incorporated for the purpose of constructing and operating an electric railway. Among those interested in the project are O. M. Thomson, 1942 North 17th Street; Chas. P. Horr, John McLennon and Thomas C. McConnell, all of Philadelphia.

THE ARKANSAS CITY & NORTHWESTERN CONSTRUCTION COMPANY, Jersey City, N. J., capital stock $500,000, has been formed to build, maintain and operate railways and steamboat lines, and to construct, develop and promote electric railways. Marion W. Lewis, Boston, Mass.; J. B. Leake, New York, and Geo. L. Dayton, Jersey City, N. J., are the organizers.

THE CORO & LAVELA RAILWAY & IMPROVEMENT COMPANY, Jersey City, N. J., capital stock $500,000, has been incorporated to construct, build and operate a railway to be operated by steam, or other motive power, between Coro and Lavela, Venezuela. The incorporators are Adolph Pereira and Francisco Bonilla, Brooklyn, N. Y., and George L. Dayton, Jersey City, N. J.

THE ELECTRIC TRANSPORTATION COMPANY, capital stock $25,000, has been incorporated at Jersey City, N. J., for the purpose of manufacturing and dealing in electric boats to engage in inland navigation. The promoters are Frank Ribbett, Rahway, N. J.; Samuel D. Collett, Brooklyn, N. Y.; Edward B McCleas, George F. Evans and Charles E. Ainsworth, Jersey City, N. J.

PEORIA & FORT CLARK STREET RAILWAY COMPANY, Peoria, Ill., capital stock $150,000, has been formed to acquire, build, buy, own and operate street railways and plants for producing electricity, and to use, furnish and sell electricity for operating street railways, for light, heat and power purposes. The incorporators are William Burry, Emory D. Frazer and Charles S. Williston.

THE CRANDALL ELECTRIC SIGNAL COMPANY, Jersey City, N. J., and Washington, D C., has been formed for the purpose of manufacturing and selling electrical devices for the display of signals, monograms, figures, words, designs, etc., by Lucien S Crandall, Parish, N. Y.; James Curran, Hoboken, N. J.; George B. Fielder, Jersey City, N. J. and Charles F. Manderson, Omaha, Neb. Capital stock $500,000.

THE LABURT ELECTRIC RAILWAY COMPANY, New York, N. Y., incorporated in West Virginia, with a minimum capital stock of $500 and a maximum capital of $3,000,000, to conduct, operate and maintain inventions, letters-patent, etc., improvements in the mechanical arts, electrical and other sciences. The incorporators are John La Burt, Brooklyn, N. Y.; Lis Michaelis, Alex. M. Lowery, New York City, and Irving Hull, Bridgeport, Conn.

THE WEST SHORE RAILWAY COMPANY, San Francisco, Cal., capital stock $2,000,000, has been formed to construct and operate a railway to be operated by steam, electricity or other motive power; to construct and operate telegraph and telephone lines; and to operate steam boats. Among those interested in the project are C. H. Sanger, San Leandra; Behrend Joost, John W. Eisenreith, San Francisco; Louis F. Dunand, San Rafael, and R. S. Thornton, Colma.

THE IRON MOUNTAIN RAILWAY COMPANY, San Francisco, Cal., capital stock $100,000, has been incorporated for the purpose of constructing and equipping a railway to be operated by steam or electricity from the Iron Mountain mines to Spring Creek Crossing on the California and Oregon Railway. The incorporators are Louis B. Parrott, Charles P. Ells, M. M. O'Shaughnessy, San Francisco, Cal.; Alfred Fellows, Newcastle-on-Tyne, England, and Charles W. Fielding, London, England.

THE SACRAMENTO, FAIR OAKS & ORANGE VALE RAILWAY COMPANY, Sacramento, Cal., has been incorporated wth a capital stock of $500,000, for the purpose of constructing, owning and operating a railway from Sacramento to Orange Vale, the road to be operated by steam, electricity, compressed air or any other motive power. Among those interested in the project are L. T. Hatfield, Thomas B. Bell, Frederick Cox, William Schaw and George M. Mott, all of Sacramento, Cal,

NEWS OF THE WEEK.

SENECA FALLS, N. Y.—The electric railway at this place is being extended.

FRANKFORT, N. Y.—Work has been commenced on the construction of the electric road at this place.

SYRACUSE, N. Y.—The extension of the Syracuse Street Railway to South Onondaga is contemplated.

HANSON, MASS.—The citizens are now talking of building an electric railway from this town to Whitman.

FINLEYVILLE, PA.—The people of Finleyville and of Liberty are agitating the building of an electric line.

ELIZABETH, N. J.—John Kean is interested in the proposed construction of a trolley line from this place to Summit.

HOT SPRINGS, ARK.—A company is being formed to build an electric road from Hot Springs to the Cuachita River.

HARTFORD, CONN.—The Newington Tramway Company will build a trolley line between this city and New Britain.

DIGHTON, MASS.—Work has been commenced on the construction of the Dighton, Somerset & Swansea Electric Railway.

BALTIMORE, MD.—The Baltimore, Columbia & Maryland Railway Company contemplates building two electric power houses.

BURLINGTON, IA.—It is reported that the Burlington Electric Railway Company will extend its lines to West Burlington.

CHATTANOOGA, TENN.—The extension of the Chattanooga Electric Railway is contemplated from this place to Rossville, Ga.

NEW BRUNSWICK, N. J.—It is reported that the trolley line is to be extended from this place to Metuchen and Boundbrook.

SYRACUSE, N. Y.—The City Council has passed ordinances giving the Syracuse Street Railway Company the right to build two extensions.

WATKINS, N. Y.—The Board of Directors of the Watkins & Havana Electric Railway Company have accepted the various franchises granted them.

COHOES, N. Y.—The Cohoes City Railway Company has obtained permission from the State railway commissioners to operate the road with electricity.

MILWAUKEE, WIS.—A company has been formed in Milwaukee for the purpose of constructing an elevated bicycle road from Milwaukee to Chicago.

UTICA, N. Y.—The Utica & Herkimer Street Railway Company has applied for permission to build and operate an electric railway through this city.

BRUNSWICK, GA.—Mesrs. W. A. Jeter and A. H. Lane have applied for a franchise to extend the Brunswick Street Railway and equip it with electricity.

RICHMOND, VA.—It is reported that the Richmond Railway & Electric Company is contemplating the extension of the system along Broad and other streets.

MILFORD, DEL.—An electric railway is projected to connect this town with Dover. Permission has been granted the company to lay its tracks and operate the cars.

CINCINNATI, O.—Herbert Miles, 902 Neave Building, is organizing a company for the construction of a four and one half mile suburban electric railway in Southwestern Ohio.

KANSAS CITY, MO.—The Kansas City Elevated Railway Company, of which Robert Gilham is manager, proposes to build an elevated viaduct 644 feet long for an electric and cable road.

HAMILTON, O.—It is understood that Peter G. Thompson will shortly begin the erection of an electric belt line, connecting with the Hamilton & Lindenwald Electric Transit Company.

CHESTER, PA.—An ordinance has been passed granting the Prospect Street Railway Company the right to construct, operate and maintain a street railway in the borough of Prospect Park.

LONG BRANCH, N. J.—The Long Branch commissioners have granted the West End & Long Branch Railway Company permission to operate a double-track railway on Second Avenue.

SYRACUSE, N. Y.—The Syracuse & Oneida Lake Electric Railway Company has been granted permission to construct, maintain and operate a single track surface street railway through the city.

KANE, PA.—A stock company has been organized and charters secured for the purpose of putting in an electric street car line through the principal streets of Kane and running out to the suburbs.

SPRINGFIELD, O.—A franchise has been granted to the Springfield, Cedarville, Clifton & Jamestown Electric Railway Company to construct and operate an electric railway between the points named.

BRIDGEWATER, VA.—B. W. Whitmore and G. W. Berlin are interested in the construction of an electrical line from Basic City to Bridgewater, to connect with the Chesapeake & Western road, now being built.

SPRINGFIELD, MASS.—The Woronoco Street Railway Company has awarded the contracts for an engine for its new plant to the Stearns Company, of Erie, and for a generator, to the Westinghouse Company.

SOUTHBRIDGE, MASS.—It is proposed to build a seven mile electric road at an estimated cost of $100,000, from Sandersdale to Globe Village. C. D. Paige, of the Board of Trade, and Thomas P. Robinson are interested.

SOUTH ORANGE, N. J.—The South Orange Board of Trustees have granted the South Orange & Maplewood Street Railway Company a franchise to lay tracks on South Orange Avenue, and work will be commenced soon.

TROY, N. Y.—Sealed proposals were received at Corporation Hall, Green Island, by George A. Van Bergon, chairman, for the construction of a flume, wheelpit and tail race for an electric light station.

CICERO, ILL.—The city authorities have passed an ordinance giving the Chicago & Northern Pacific Railway Company the right to erect poles and wires, and to use electricity instead of steam as a motive power within the city limits.

PHILADELPHIA, PA.—An action has been begun by James Fynon and others against the Philadelphia Traction Company to restrain the latter from laying down a double track on East Susquehanna Avenue, from Memphis to Beach Street.

WEST ORANGE, N. J.—The Suburban Traction Company, through its receiver, Watson Whittlesey, will make application to the Common Council at its next meeting for a franchise to construct a line from Scotland Street to its West Orange line.

NEW BRITAIN, CONN.—The matter of an electric road between this city and Hartford is assuming definite shape. The Central Railway & Electric Company prefer to build the line via Stanley Quarter. About $15,000 will be necessary for the proposed line.

LOWELL, MASS.—The Lowell & Suburban Street Railway Company appeared before the Railway Commissioners this week with a petition asking for the approval of an issue of $400,000 stock for the purpose of reconstruction and equipment with electricity.

BATESVILLE, IND.—The Batesville & Oldenburg Railway & Electric Company, B. S. Sutton president, has been granted a franchise. Work will begin in 60 days on the section between Batesville and Oldenburg, and afterward extend to Osgood, 16 miles south.

BUFFALO, N. Y.—Sealed proposals will be received by the Buffalo, Gardenville & Ebenezer Railway Company, 47 Dun Building, this city, for furnishing the material and constructing an electric railway, four and one third miles in length. Charles Schoepflin is president and can furnish particulars.

NEW ORLEANS, LA.—St. Bernard Parish is to have an electric railway. It will be constructed by the Chaumette Railway Company in which the following are interested: R. V. Ducros, E. E. Nunez, C. D. Armstrong, L. Roy, A. Estopinal, Jr., Senator A. Estopinal, B. Ojeoa and J. D. St. Alexandre.

ST. JOSEPH, MO.—The first step in the building of an electric line to St. George has been taken by the St. Joseph Traction & Lighting Company. The company agrees to commence work within 90 days after the passage of the ordinance, and have the road completed within six months thereafter.

MT. CLEMENS, MICH.—The Mt Clemens Street Railway and Lakeside Street Railway companies have consolidated and reorganized under the name of Mt. Clemens & Lakeside Traction Company. The new company will equip all its lines with electricity as rapidly as possible, and add many attractions to its system.

MILWAUKEE, WIS.—A franchise has been asked for by Chicago capitalists, headed by Congressman McGann, to build an electric line from South Milwaukee through the city to North Milwaukee. The enterprise is backed by ex-Congressman Peter J. Somers and other local capitalists. A four-cent fare is promised.

WESTFIELD, N. Y.—W. L. Minton and his attorney, A. B. Ottoway, of Westfield, have secured an option for a year and a half on most of the right of way between Barcelona and Mayville. The project of an electric road from Lake Erie to the Chautauqua Assembly Grounds is contemplated and this is a move in that direction.

NIAGARA FALLS, N. Y.—The Niagara Falls & Lewiston Electric Railway was formally opened on July 18. The road is seven miles long and runs at the foot of the 160-foot bank along the gorge of the Niagara River, the road being cut most of the way in the solid sloping rock. The road cost over $1,000,000 and is owned by Buffalo and New York capitalists.

ST. LOUIS, MO.—A license has been granted to the Southern Electric Railway Company by Secretary of War Lamont to lay tracks in the Government reservation at Jefferson Barracks. Winthrop Bartlett is the engineer in charge, and the officials say that the addition between its southern terminus, at River des Peres and Jefferson Barracks, will be ready for traffic on Oct. 1.

KANSAS CITY, MO.—The Northeast Electric Railway has filed a petition with the County Court at Independence for a franchise allowing it to extend its tracks along St. John Avenue from the present terminus at Burge Park 1,600 feet to Budd Park. If this is granted the work of construction will be pushed ahead without delay and the cars will be running to Budd Park in a few weeks.

TRADE NOTES.

THE PARIS HOUSE of the Boudreaux Dynamo Brush Company, of New York and Chicago, received last week a letter from the Director of Material, French Navy Department, advising that "in consequence of the satisfactory results obtained with Boudreaux foliated brushes in the port of Brest," the writer has "authorized the use of them in the five French ports and the establishments of Indre and Guerigny."

GRAPHITE PIPE-JOINT COMPOUND, 12 or 15 years ago, was known under the name of "smear grease," and later was changed to "pipe-joint grease." It really is not a grease, and as the name has caused some misunderstanding, the manufacturers, Jos. Dixon Crucible Company, Jersey City, have decided to change it to "Dixon's graphite pipe-joint compound." This compound under one or another of its several names, has been in the market for about 20 years. It is not only useful for joints, and all steam, gas and water piping, but is equally useful for smearing gaskets and flange-joints of meters, traps and for bolts, screws, etc. It is infinitely superior, both in usefulness and economy, to red lead, and the Dixon Company recommends it as such with the fullest degree of certainty.

J. H. GRAHAM, general manager of the Graham Equipment Company, of Boston, has just returned from a most successful trip through the South and Southwest, bringing with him orders to the amount of about $40,000. Mr. Graham reports business in the South as most prosperous. The steel car now being made by the Graham Equipment Company, and which takes the place of the old style, with a separate car body and separate truck, has attracted the attention of every railway man to whom it has been shown. Mr. Graham secured orders for over 40 of these steel cars. The company has just made a shipment of one of these cars to Tampa, Fla., and is looking forward to increased business in the South.

GEORGE C. EWING, for two years connected with the Composite Brake Shoe Company, of Boston, Mass., is engaging in business for himself at 620 Atlantic Avenue (Hathaway Building), Boston, dealing in high grade street railway supplies. His list of specialties is already quite numerous and embraces the well-known line material of the Ohio Brass Company, Medbery insulation, Universal non-arcing lightning arresters, Pittsburg trolley poles, Peerless commutator compound, woven wire dynamo brushes, Wadham's oils and greases, and the track supplies of the Mark Railway Equipment Company, of Chicago. Mr. Ewing is a young man full of energy and he will undoubtedly, through the new departure, add to the success he has already made for himself.

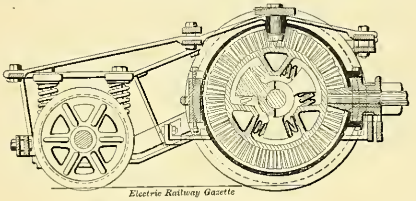
ELEVEN O'CLOCK, P. M., is now the hour at which the factory of J. Grant High & Co., 123 North Third Street, Philadelphia, is closed for the day—or the night—this state of affairs being rendered necessary by the quantities of orders received. One of the firm's leading specialties is switchboard work, and orders for boards have recently been received from the following places: Light & Power Company, Anaconda, Mont.; League Island Navy Yard; Bay View Insane Asylum; Bethlehem Silk Works, Bethlehem, Pa ; Joseph Bancroft & Sons, Wilmington, Del.; Grand Hotel, New York; Philadelphia Bourse (four boards); Tokio, Japan; San Francisco, California; Chili and Cuba. Mr. J. Grant High spent a day in New York last week, and as a result took home an order for a very fine switchboard.

THE AMERICAN BOLT COMPANY, of Lowell, Mass., with its business existence of nearly 50 years, and Mr. M. F. Brennan, its general manager, who has been actively identified with it for nearly 30 years, is one of the few exceptional instances. This company has always occupied a conspicuous position in business circles, and the enterprising and progressive business spirit of Mr. Brennan still keeps it prominently in the foreground. In street railway specialties it is "up to date," and is securing deserved recognition. Its list of manufactures embraces a varied assortment, such as trolley wire hangers, bond rivets, track bolts, tie rods, bond wires, turnbuckles, eye bolts and pole clamps for span wires, lag or drive screws, feeder wire insulator pins tree insulators, cross-arm pole clamps, pole steps, feeder wire safety hooks, car station signs, truss rods building iron for power stations, special forgings, bolts, nuts, washers, a variety of screws and many other specialties.

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED JULY 16, 1895.

542,617. RUNNING GEAR FOR ELECTRIC RAILWAYS; Bion J. Arnold, Chicago, Ill., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed April 13, 1891. The electric motor is carried in a frame mounted on spring-supported trucks and a gear having a rigid bearing therein is operated by the motor. The driven gear wheel meshes therewith and surrounding the axle and shares the movements of the motor relatively to the axle, so as to preserve it in fixed relation relatively to the motor. Elastic couplings join the gear wheel and the axle. (See Illustration.)



No. 542,617.—RUNNING GEAR.

542,655. AUTOMATIC ATTACHMENT FOR SWITCHING CARS; Joseph Phelps, Newark, N. J. Filed Nov. 23, 1894. This is a switch-operating device and comprises a foot piece upon the car platform with a depending stem projecting through it. The bell crank of a lever is mounted in a suitable bracket upon the bottom of the car and has a lateral projecting arm with a concave-bearing plate designed to receive the end of the stem and depending arm. The bell crank is sustained in a suitable bracket upon the car bottom in the rear of the bell crank and has an upwardly projecting arm connected by an adjustable rod with the depending arm of the bell crank. A spring is secured at one end to the upright arm of the bell crank and at the other to the car body. A vertical sliding bar is mounted in a suitable bearing upon the car frame and provided at its upper end with an eye to receive and engage the lateral arm of the crank.

542,666 RAIL-JOINT; Orson F. Wickham, Pentwater, Mich., assignor of one half to William B. O. Sands, same place. Filed May 7, 1895. Overlapping rails are used each formed with an undercut recess in respectively opposite sides. There are hooked extensions on the other sides of the rails adapted to engage the undercut recesses to prevent disconnection of the rails by lateral displacement.

542,675 INSULATING SHIELD FOR METALLIC POLES; William J. Braley, Fall River, Mass. Filed April 17, 1895. The shield consists of sections of longitudinal insulating material with their edges jointed together so that they form a tube, about which bands of wire are wrapped.

542,720. CAR FENDER; Morris Weiss, New York, N. Y. Filed April 27, 1895. A turning support is provided for a car fender and a wheel, a rack and pinion are supported in line on the support. A driving wheel is in position to engage with the wheel previously mentioned and the rack and pinion successively so that the fender may be elevated.

542,749. CAR FENDER; Robert Bateson, Fall River, Mass. Filed May 3, 1895. The fender has a fixed bottom and ends with a back hinged at its upper edge. A bar extends across the front of the fender and to it and to the bottom a flexible curtain is attached. Springs are provided for raising the bar with fingers on the back extending forward so as to rest normally on the bar.

542,774. CAR FENDER; William E Moulton, West Troy, N. Y., assignor of one half to Joshua Mors and George Caswell, same place. Filed Oct. 6, 1894. The car guard has a concave or scoop form in cross-section, made with a fender on its lower edge and provided with concave cross braces and laterally arranged slats. It has its upper edge hinged or journaled on the car truck in front of the wheel. A spring is downwardly projected from the truck and is arranged back of the guard so as to engage with the latter.

542,776. STREET RAILWAY CAR; Lewis T. Pyott, Philadelphia, Pa., assignor of one half to Daniel A. Waters and William G. Vernon, same place. Filed March 12, 1895. This is a combination with a car body of an under framing on each side of the car and an equalizing beam attached to the under frame of one side of the car only.

542,778. CAR FENDER; George B. Riggins, Brooklyn, N. Y. Filed May 24, 1895. The supporting frame is secured to the car bottom and extends forwardly therefrom and carries outwardly extending posts. A cross rod connects the posts and a single pair of arms is suspended from the cross rod near the opposite ends thereof. A forwardly projecting fender frame is pivoted to the arm and is provided at its front edge with a cushion and on the under side with trucks. Sliding spring-pressed buffer rods are mounted on the supporting frame behind the fender frame and are pivotally connected with the fender arms.

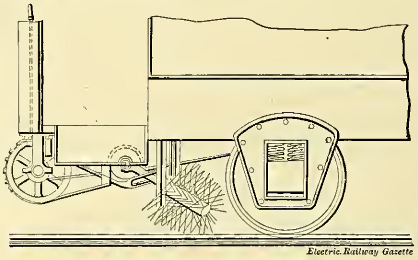
542,832. SAND BOX FOR CARS; Henry McPherson, Troy, N. Y., assignor of one half to William Sleicher, Jr., same place. Filed May 1, 1895. The sand box has a trunnion-supported sand drum with a perimetrical spout and fixed bearing supports. There is a bearing sleeve rotary within the support and upon the drum trunnion, means being provided for imparting to the sleeve a rotary movement and for locking the sleeve against rotary movements. A retraction spring is secured at one end to the sleeve and at the other end to the drum.

542,836 LIFE GUARD FOR STREET RAILWAY CARS; Michael Riley, London, O. Filed March 25, 1895. The spring frame is supported from the truck frame and a bumper wheel is detachably and adjustably supported in the spring frame.

542,841. CAR FENDER; Joseph Brautigam, Brooklyn, N Y. Filed April 17, 1895 Two frames project from the dashboard of the car and swinging frames are hinged to them. A frame is hinged to the front bottom parts of the swinging frames with means for holding both the latter and the frame hinged thereto in a raised position. Means are provided for automatically releasing the frame and a spring is attached to the swinging frames and to the projecting frames A netting is secured to the projecting frames and the rear bottom parts of the swinging frames.

542,877. LIFE-SAVING NET FOR CARS; Lawrence Dulligan, Rochester, N. Y. Filed Sept. 16, 1893 There are ways on the car on which slides are movable with a net frame pivoted on the slides. Springs move the slides forward and retaining devices hold the network retracted against the tension of the spring.

542,918. STREET CAR FENDER; William Barker, Philadelphia, Pa. Filed June 11, 1894. The fender frame has a transverse buffer at the front and a pick-up bar. Rods are guided in the buffer bar and have pivotal connection with the pick-up bar, springs being provided for projecting the rods and one also for maintaining the pick-up bar in a vertical position. There are stops on the guide rods for restricting the movement of the pick-up bar under the action of the spring.



No. 542,977.—TRACK SWEEPER.

542,977. TRACK-SWEEPING ATTACHMENT FOR STREET CARS; William H. Penny, Danbury, Conn., assignor of one half to Henry H. Turner, same place. Filed Sept. 21, 1894. This is a track-sweeping machine with a transverse driving shaft. The inclined shafts are connected by universal joints at their outer ends and are supported in vertically movable bearings and carry brushes. Separate rock shafts have slotted crank arms through the slots of which the brush shafts pass, means being provided for rotating the rock shafts and thereby raising or lowering the brushes. (See Illustration.)

542,980. SWITCH-ACTUATING APPARATUS; George T. Janvrin and Frank J. Conlon, Brooklyn, N. Y. Filed Dec. 12, 1894. Roll carrying staffs are pivoted to the body of the car and are connected by a horizontal rod to a bell crank lever attached to the under side of the car platform. The switch-operating mechanism is operated by a push pin.

Electric Railway Gazette.

Vol. XIII. NEW YORK, AUGUST 3, 1895. No. 5.

New Jersey Electric Railway Company.—III.

That part of the system known as the Paterson, Passaic & Rutherford Electric Railway, extends from Rutherford through Passaic and Paterson to Singac, passing through fourteen cities and villages having an aggregate population of about 400,000 people. The line from Paterson to Little Falls and Singac extends along the bank of the Passaic River, and the scenery along the route is very attractive.

The company is the consolidation of five different companies and includes the Paterson & Little Falls, Grand Street Electric Railway, People's Park Electric Railway, Paterson & Passaic Electric Railway and Passaic, Rutherford & Carlstadt Railway companies.

The track construction throughout is of a very substantial character, being laid in Paterson and Passaic with seven and nine inch girder rail and throughout the balance of the line with a 70 lb. T-rail. The rails are spiked to six by eight inch oak ties. Octagonal wooden poles are employed throughout for the overhead construction, except in the city of Paterson, where iron poles are used.

Current for operating the road is supplied from the station of the Edison Electric Light Company in Paterson.

Thirty-six miles of No. 0000 feed wire has been put up for the operation of the portion of the road between Paterson and Rutherford, a distance of nine miles. The feed wires are arranged in lengths ranging from three and one half miles to the full distance.

The Westinghouse system is employed, and the cars are similar in design to those in operation on the Jersey City, Hoboken & Rutherford section of the system, and were supplied by the J. G. Brill Company and the St. Louis Car Company.

Thirty-five cars are in operation on the line and a high rate of speed is maintained in the suburban districts. There are three car houses, the main barn located at Rutherford, one at Singac which has a capacity of twelve cars, and one recently completed at Lake View with accommodations for twenty cars.

The main car house is shown in Fig. 1. The building is a substantial structure of brick, with a corrugated iron roof, supported on iron trusses. There are five tracks in the building, each of sufficient length to accommodate five cars. Pits are provided under each track, and extend the entire length of the building. The floor of the building and the bottoms of the pits are of concrete. The tracks are arranged so that there is a slope from back to front of fifteen inches in 100 feet, and the tracks extend beyond the building a distance sufficient to accommodate all of the cars, so that they may be quickly run out by gravity in case of fire. On a pole in front of the building a switch is located by which the current may be cut off from the wires inside of the house in case of necessity.

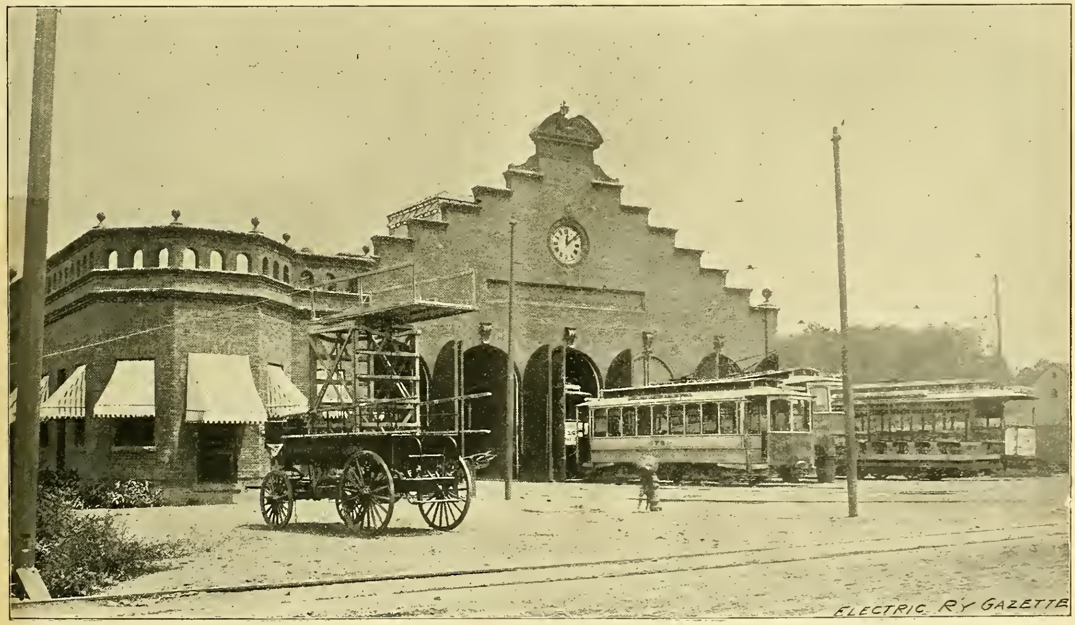


FIG. 1.—MAIN CAR HOUSE.

A complete high-pressure steam-heating system has been installed, comprising a fifty hp vertical boiler, located in a separate room adjoining the machine shop, and steam pipes extending throughout the building. Steam coils are also provided for each of the pits. The system is provided with gravity return, and the condensation is returned to the boiler through a Keiley trap.

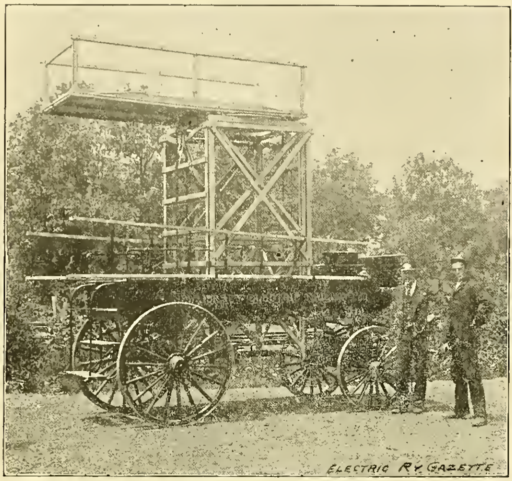


FIG. 2.—TOWER WAGON

The machine shop is located in a wing on the west side of the main building and measures 25 x 50 feet. The shop is fully equipped with modern machine tools and appliances for making all necessary repairs. Adjoining the machine shop is a storeroom 9 feet 6 inches x 25 feet. The offices and waiting rooms are located in the front part of the wing shown on the left in Fig. 1, and a large, well-lighted and ventilated waiting room is provided for the use of employees. Excellent provision has been made for the protection of the building in case of fire. Two-way fire hydrants are located at the front and rear of the building and are connected to the water main in the street, where the pressure is never less than 50 pounds to the square inch. The company has recently added to the equipment of the road a new type of tower wagon, shown in Fig. 2, which was built by McCardell & West, of Trenton, N. J. The tower is raised or lowered by a crank and gears, and the platform is arranged to turn on a pivot so that it can be swung under the trolley wire, while the wagon remains at the side of the track, enabling the linemen to work on the wire without interfering with running of the cars.

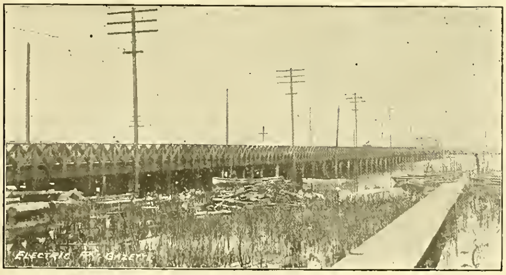


FIG. 3.—BRIDGE OVER THE HACKENSACK.

A trestle bridge 1,000 feet long built by the company over the Hackensack River is shown in Fig. 3. Fig. 4 shows a view of the bridge over the Passaic River, at Passaic. At this point a 500,000 circular mil armored cable runs under the river and is connected with the feeders on each side. The return cable is of galvanized iron about one inch in diameter, uninsulated and laid in the water.

On the line between Rutherford and Passaic the company found it necessary to build a retaining wall for a distance of 1,200 feet. The wall is of stone ten feet in height, and is provided with guard rails along the entire distance. For a short distance on the line between Passaic and Paterson the company has its own right of way, under which another very substantial bridge was built over Weasel Creek.

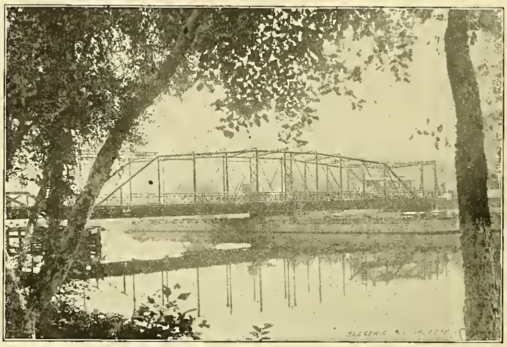


FIG. 4.—BRIDGE OVER THE PASSAIC.

The officials of the company are Charles A. Johnson, president; J. A. Morrisse, vice-president; Louis Fitzgerald, treasurer; John McGuinness, Jr., secretary, and Sidney Rowlands, resident engineer.

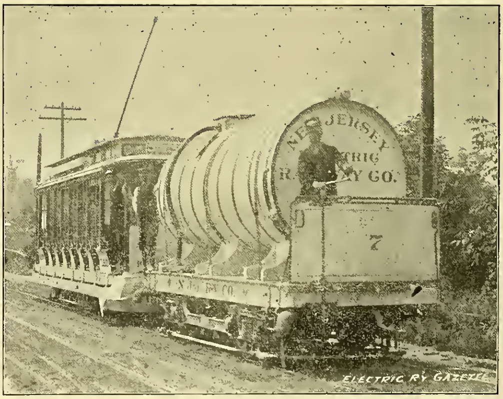


FIG. 5.—A MIXED TRAIN.

The road was laid out and built by Lemuel W. Serrell.

The portion of the system extending from Rutherford to the Hoboken ferry, recently described in the Electric

Railway Gazette, was laid out by Thos. H. McCann, and constructed under his supervision. Mr. McCann was ably assisted by Daniel Valentine, mechanical engineer; A. H. Hayward, manager; Albert Beyer, architect, and Alfred Debevoise, superintendent.

Heilmann Locomotives.

The discussion of H. Ward Leonard's paper on "Notes on Recent Electrical Engineering Developments in France and England," by members of the American Institute of Electrical Engineers, in Chicago, was devoted, in the main, to that portion relating to the Heilmann electric locomotive. B. J. Arnold said of the machine: "Some months ago, when the Heilmann locomotive made its appearance, I expressed a very decided opinion against the general plan of the machine and what was claimed for it. I have watched its record as closely as possible from the technical press, and fail as yet to see good reasons for changing my views regarding it. The only possible advantages it seems to me to have, are the ability of applying a continuous rotating effect or torque to the drivers, and the abolition of counterbalancing, which is destructive on roadbed and track. It has all the disadvantages of the ordinary locomotive, so far as cleanliness is concerned, and is still further handicapped by its excessive cost and extra expense for men in operating it. I think its chief function will be as an entering wedge for the adoption of electric traction on steam roads, or, rather, as a go-between between the steam locomotive and the electric motor driven from a central station."

Prof. W. M. Stine said: "Analyzing the weight of a locomotive, we may divide it into three factors. The one factor is that of the supply weight, and the weight of the tender itself. The next factor is the dead weight on the pony wheels, and the third factor is the tractive weight on the driving wheels. If we average the tractive weight of the ordinary express locomotive, the dead weight reaches the large value of 40 per cent. We may accept this as the real condition of affairs, but the 40 per cent. dead weight is what, to a great extent, is causing the present railway financial condition. Much of the increase in the cost of construction and maintenance of the railways seems to be necessitated by the useless weight carried by the engine. It is not the train so much as it is the dead weight of the locomotive which is responsible for these things. If electricity is ever going to accomplish anything at all, it must be in lessening this 40 per cent. dead weight. The question of the Heilmann locomotive is whether it can be reduced to the necessary tractive weight. I think that the total tractive weight is not excessive for the speed the locomotive can attain. This question was raised the other day by a railway man, and for this reason I have made an analysis of the Heilmann locomotive."

C. K. MacFadden said: "That part of the paper referring to the Heilmann locomotive was the most interesting section to me. I have made a number of tests on passenger locomotives on one of our largest western roads, and I was prepared to find some very peculiar results when I started in on that work. My experience, I must confess, was very surprising when, in taking my first indicator cards from a modern ten-wheel engine, I found them to very closely resemble cards taken from an automatic high-speed electric light engine, whose valves were in first-class condition. The boiler had about 1,400 square feet of heating surface, and I have taken cards from the engine it supplied up to 1,000 hp. This locomotive was one on which it was impossible to make the wheels slip, even with a full boiler pressure, which varied from 160 to 170 pounds. The speed ran as high as 70 miles per hour and over, and all tests made were on locomotives running in the regular fast passenger service. The engine was a new one weighing 90 tons, and the total weight of train was 450 tons. I have here a few cards taken in this test. The first card shows the action of the valve motion when the point of cut-off is being altered. The second shows the steam distribution when the engine is developing 540 hp at 26 miles per hour; the third card shows the engine running at a high speed, 66 miles per hour, developing 904 hp; the fourth shows it running at 42 miles per hour, 641 hp, and the fifth shows it at 36 miles per hour, 720-hp.

"I will say that I quite agree with Mr. Arnold in regard to the Heilmann locomotive. I can hardly see where the immense economy can be attained by using such a system. The first thing to be considered is the original cost. The cost is given as $30,000, and, though this is but a single locomotive, the chances are that it would cost $25,000 in lots of ten. A locomotive can be bought for $8 500 to $8,700, of the size spoken of, on which tests were made by me. It will develop 600 hp continuously. The wages of a competent road engineer are undoubtedly much higher than that of a stationary engineer, and the wages of the help required on the Heilmann locomotive would certainly be even greater than on a common locomotive. Of course we know that it is useless to expect the steam railway to incur the enormous expense necessary to give electric traction a trial, unless there is no doubt of its making a large saving over steam. When the Heilmann locomotive is given a thorough trial, the test of electrical traction will have been at an expense of only $30,000. I think the electric locomotive has much to commend it for high-speed service, but I do not think that it will come into common use in the form shown in the French engine, but I think that as a motor at the front of a train it will have its greatest value. I would say in conclusion, that the average locomotive is hardly a fit standard from which to judge the saving to be effected by the use of electricity. There is often a great difference in different engineers, sometimes 30 per cent. being the saving effected by one engineer over another on the same train and engine. Three months' work among the engineers of a prominent western railway by its superintendent of motive power has already effected a saving which will pay 6 per cent. interest on nearly $2,000,000, and he thinks his work has hardly commenced."

Renewing Steel Rails.

Instead of consigning worn out steel rails to the scrap heap, as heretofore, a process has been patented and put in successful operation for re-rolling them. The method consists in heating the old rail below the decarbonizing point and then replacing the displaced steel.

The Nashua & Lowell Road Opened.

The Nashua & Lowell road was formally opened last week, and a special car was run down to Lakeview with a party of prominent Nashua men aboard as guests of the company. From Lakeview the party was taken to Lowell, where a superb collation and a number of entertaining speeches and toasts were enjoyed.

The Nassau Electric Railway Company Victorious.

On Friday of last week the General Term of the Supreme Court handed down a decision in which the ruling of Judge Smith was reversed in the matter of the Nassau Electric Railway Company, known as the Flynn syndicate line. Recently the company, after expending some millions of dollars in construction of lines, was defeated in an action, and all its work was brought to a standstill.

In the reversal of this decision the General Term judges yesterday handed down two opinions, one by Judge Dykman, the other by Judge Brown, both in favor of the Nassau road and both concurred in by the other General Term Judge, Calvin E. Pratt. The result is that the uncompleted work will be carried out and Brooklyn will have a trolley system by which for one fare, five cents, passengers will be carried from the Broadway, Thirty-ninth Street and Hamilton Avenue ferries to Canarsie, Bay Ridge, Fort Hamilton, Sheepshead Bay and Coney Island.

The litigation was begun in March, 1893, when the Nassau Electric Railway Company applied to the Common Council of Brooklyn for permission to build trolley lines through certain streets and avenues in the city. On the return day of the application a company known as the Union Street Railway Company also applied for permission to construct lines over the same route. This company offered $250,000 for the franchises, but the Common Council granted the franchises to the Nassau road, on an agreement to pay certain stated percentages on its gross receipts.

Judge Brown commences his opinion by stating that no allegation in the complaint claims that the aldermen were corrupt, or that the consents were obtained corruptly, as stated in the opinion of Judge Smith, from which the present appeal was taken. He also held that the absolute control of the streets and the directions as to their use were vested in the Legislature, and that the constitutional provision requiring the consent of local authorities to the construction and operation of street railways was not abridged by legislative power.

In concluding his opinion Judge Brown says: "The testimony shows that all the proceedings before the Common Council were regular, and that no formality made requisite to its final action was omitted, and as the right to grant consent to construct a railway in the streets of the city is not the property of the city, and the local authorities are not required to grant such consent to the highest bidder, the conclusion necessarily follows that the grant to the defendant companies was a valid exercise of legislative power, and as such is not within the province of judicial review."

Judge Dykman says: "As there is no cause for the interference of the Court upon the ground of fraud, so we find no reason for interference by reason of waste or injury to the funds or property of this city, even according to the most technical definition of those terms. In the sense in which they are employed in the statute they include only wrongful or dishonest, illegal action, as we have already seen. The case has attracted much public attention, chiefly because it arose at a time when there was considerable excitement in the public mind. But the courts are beyond the voice of clamor and must decide the law with serenity and independent of external strife or opinion."

James C. Church, counsel for the Nassau road, states that work will begin at once toward completing and operating the line. The line from Canarsie requires only a few more hours' work, and with the Marcy Avenue line, running from the foot of Broadway to Sheepshead Bay is now running.

Edward M. Grout, chief counsel of the Union Street road, states that the matter would be taken to the Court of Appeals.

An Electric Railway From Detroit to Mt. Clemens.

The Rapid Railway's electric line between Mt. Clemens and Detroit has been in successful operation since July 1 last, and its steadily increasing patronage has clearly demonstrated that there was need of such connection between the two cities. Since the opening of the line, four motor cars have been in operation on week days, and on Sundays, when the traffic is much greater, trailers are employed. The residents of Mt. Clemens have found the line a very great convenience. Cars leave that city every forty minutes, and land passengers in Detroit in a little over an hour. In the same way persons living between terminals and adjacent to the line find the comfortable and speedy cars a boon. A trip over the line is a very attractive ride, and can be made from the Detroit River to the Sherman House in Mt. Clemens for twenty-five cents. The line is very nearly straight, and passes through one of the finest agricultural districts in Michigan. Stops are made at all highway crossings and road houses to take on and let off passengers.

After leaving Leesville, the first place of importance is the Westphalia Shooting Club Park. A special car is run to and from the park every Sunday for the accommodation of a large number of Detroit's German citizens, with whom this resort is very popular. The next stopping place is Roseville, an attractive country village. At the company's power house eight miles from Mt. Clemens is another station. Several cottages have been built at this point for the accommodation of the company's employees. From here to Mt. Clemens the landscape is particularly attractive.

The city is finely situated on gently rolling land at the head of navigation, on the Clinton River, which runs through part of the city, thus greatly adding to its attractiveness as a pleasure resort as well as contributing to its commercial interests.

The railway track is single with five turnouts located at convenient meeting points. The cars are similar in appearance to those in use on steam roads, and are thirty-three feet in length, with vestibules. They are mounted on double trucks, with thirty-three inch wheels. The interiors are finished in hard wood with large plate glass windows and spring roller curtains. There are nine reversible double seats on each side of the car, arranged as in passenger coaches on steam roads, giving each car seating accommodations for thirty-six passengers. The seats and backs are of cane, and light is furnished by ten 16-cp incandescent lamps.

The active management of the line has been entrusted to P. E. Clisdell, who has an extended experience in electric railway work.

Some Practical Hints for Motormen.—X.

BY GEORGE T. HANCHETT.

Wire-wound armatures are still frequent in railway practice. In such armatures it is needful to have the coils made up of two or more wires, so that they may be turned edge on when forming the head of the armature, and thus take up less room. Fig. 30 shows an armature coil made entirely of wire, but bent so as to conform to this method of winding. These coils are usually bent to shape by a special former, which makes them all exactly alike. This method of winding a drum with wire was first used by Eickemeyer. It is in use in one of the most prominent makes of motors to day, and forms an admirable armature for the purpose, as the magnets can be placed very compactly about it.

Another advantage of separately formed coils is the admirable manner in which they can be insulated, as they may be taped separately. Railway armatures are usually of the toothed type. That is, the conductors are let into slits cut in the lammelar surface. This has the great advantage of making the motor more powerful for its weight, and also affording substantial protection for the windings. An armature of this type can be rolled across the floor without injury, while the smooth body surface-wound type would suffer serious damage by such treatment.

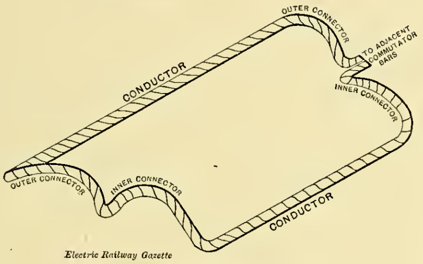


FIG 30.—ARMATURE COIL.

Surface-wound and toothed armatures require binding wires, or similar devices to keep the conductors from flying off the surface by centrifugal force. Binding wires of No. 20 B. & S. or larger, are wound about the armature with insulation interposed. They are very tightly wound and then soldered. On toothed armatures, it is very frequent to drive a wooden wedge in between the teeth, just above the coil, and thus confine it. Both methods have proved very efficient.

In the last section wire-wound drums with coils precisely alike and shaped on a former were merely mentioned. However, the method is such a good one and so common in street railway practice, that it deserves further discussion. Fig. 31 shows one of these drums in process of construction.

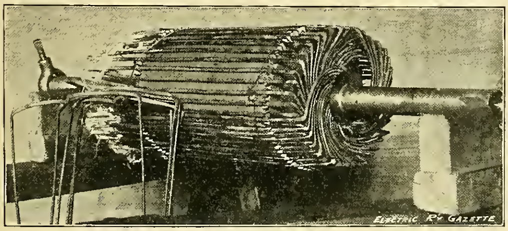
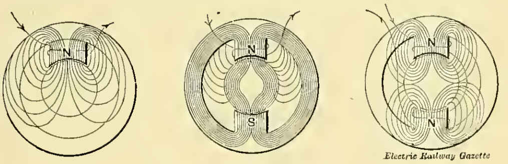


FIG. 31.—ARMATURE IN PROCESS OF CONSTRUCTION.

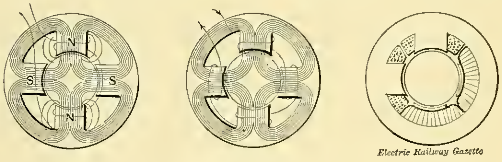
On this particular drum the wire was so stiff that bending was out of the question, after the coils had been once formed. Hence, it was necessary to form up the rear head at some distance from the core, as shown, and drive it forward into position. Once in position, the head protrudes beyond the core only one-half inch, whereas, the simple overlap winding would involve a head at least three or four inches beyond the core. Economy of space is not to be despised in railway work. The shape of such an armature facilitates surrounding it into a short compact magnetic circuit.



FIGS. 32, 33 AND 34.

We have spoken of the methods of providing a path for the magnetic lines outside of the armature, under forms of field magnets. The method that is now almost universally adopted is to provide a completely inclosing shell, either cylindrical or parallelopiped, and encasing the armature therein, the centre of rotation of the armature corresponding with the axis or symmetry of the shell. Now, if from the inner surface of the shell, a magnetic pole protrudes and presents its face in such a manner as to pour a flux of lines into the armature as a north pole would do, the lines emerge from the surfaces of the armature not covered by north poles, and seek the nearest gap spaces between the iron of the armature and the shell, in order to return through the shell to the north pole once more, and thus complete the magnetic circuit. If a single north pole is provided, the lines would leave the armature and seek the shell, as in Fig. 32. If we guide the lines a little by bringing a portion of the shell forward, as in Fig. 33, the lines of force seek the easiest path, which is via the shortest gap space. This construction, as we have before mentioned, has been successfully followed. If we present two north poles, Fig. 34, to the surface of the armature, the flux of lines behaves very much as two meeting streams of water would behave and diverge at right angles to the path in which they were projected.

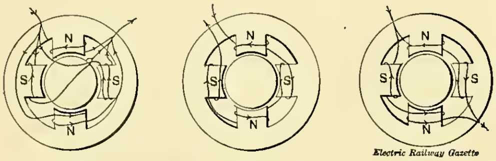
Here also we may guide the lines as in Fig. 35, providing a better path for them, and we obtain another form of field magnet largely used in railway practice. If we wind coils about the poles projecting to receive the lines of force, we obtain a third and very popular type, Fig. 36.



FIGS. 35, 36 AND 37.

These magnetic frames, shells, or motor boxes, as they are variously called, are almost entirely cast of steel. Steel can be successfully worked at an intensity of 85,000 lines to the square inch of section, while cast iron can only be successfully worked at from 40,000 to 50,000 lines to the square inch of section. Hence, a magnet frame of steel, having one-half the area of an iron frame, will weigh much less. Unfortunately, steel is liable to vary in its magnetic qualities. By this we mean, that should we have two steel magnet frames cast from different meltings of steel, but otherwise the same, we would be liable to get fields of different strengths, even though the two frames were wound with identical coils, and subjected to the same current. In railway work this would show in the speed of the motor, and as this is a variable quantity in any event, this otherwise disadvantageous quality of steel does not make so much difference.

The field coils of a railway motor are often wound on a special former and have a peculiar cross-section. Fig. 37 shows the necessity for this. In order to obtain sufficient magnetizing power, every available cubic inch of space must often be utilized. These coils, when formed up are taped and held in position with brass clamps or other means.



FIGS. 38, 39 AND 40.—FIELD WINDINGS.

Field coils are always connected in series with their armatures in railway motor work, but among themselves are often connected in multiple. It is possible and practicable to connect from field coils in three different ways, shown in Figs. 38 to 40. 1. All in multiple. 2. All in series. 3. Two in multiple and two in series. These last two methods are largely followed.

We have now described the essential parts of a railway motor and their methods of connection, and some of the theory of operation. Before taking up practical difficulties that may arise, and the remedies therefor, one other feature must be discussed, viz., the method of control. As this is one of the most puzzling features of the whole equipment, it is worthy of careful study.

The control of the speed of a series of motor may be accomplished in several ways, among which are the following:

1. Varying the potential or pressure to which the terminals of the armature are subjected.
2. Varying the strength of the magnetic field.
3. Adjusting the position of the brushes on the commutator. The speed of an electric motor depends on the equation

$$S = \frac{E}{C f K}$$

where S = the speed; E, the impressed E. M. F.; C, the number of conductors on the armature surface; f, the field strength, and K, a constant quantity. We may therefore increase the speed by increasing E or reducing C or f; K we cannot change.

The first of the methods is the most used. It has the advantage of having a wide range of control from practically 0 up to a maximum, but if used with a simple resistance, is very wasteful of power. The second method is admirable for the range that it controls, but unfortunately this is quite limited.

The third method is a possible but not practicable method, as it involves severe sparking at the commutator.

Returning to the first method of contact as applied to railway motors, that of varying the potential to which the motor is subjected, it is best to discuss the single motor first. The trolley furnishes electricity at a constant pressure. How shall we vary the pressure as supplied to our motor?

If we insert something in series with the motor to take up a part of the pressure, and have this apparatus readily variable in its capacity for so doing, we shall have reached the solution of the problem. This apparatus may be a variable resistance, or, as we shall soon see, *another motor.* With single motor cars, a variable resistance is always used. The method of field control is not so largely used on railway cars and, that by rocking the brushes, never.

However, we have not complete control of our motor, unless we can reverse it, and that makes the connections under the car even for a single motor a little more complicated. It must be remembered, that simply reversing the connections of the motor and putting the current through the other way, does not reverse the motor. The current in the field must be reversed relatively to that of the armature. Hence, we must bring not two, but four wires from our motor to the point of contact. Fig. 41 shows the method of connecting a single motor under the car. Modifications of it have been made, but the principle running through them all is the same. The dotted lines represent chains which pass over chain wheels at either end of the car. One wheel operated by the handle, *H*, operates the rheostat, *C*. The other handle operates the reversing switch, *R*. Tracing the current from the trolley, we find that it first goes through the lightning arrester, *L*, and then through the fuse box, *F*. It then passes to the rheostat, *C*, and traversing such coils as may be cut in, passes to the armature of the motor. Leaving this, it passes up to the reversing switch, *R*, which dictates which way it shall pass through the fields. In accordance with this switch, it passes through the field magnets and returns through the reversing switch to the ground screw.

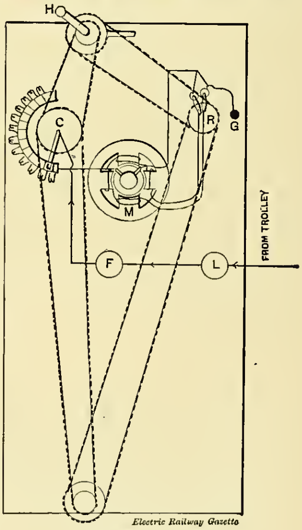


FIG. 41.—CONNECTIONS FOR A SINGLE MOTOR.

(*To be continued.*)

Street Railway Engineers.—XIV.

Merle J. Wightman.

Mr. Merle J. Wightman, consulting electrician of the Johnson Company, Johnstown, Pa., is an engineer of wide and varied experience, and, though a young man, was one of the early workers in more than one important branch of industrial electricity. He was born Jan. 19, 1865, and first became interested in electrical matters while attending the High School at Taunton, Mass., in 1878, when he built a small dynamo of about one horse power capacity, doing all the work upon an old fashioned wood-turning lathe. He covered all the wire by a machine built for the purpose. In 1880 he built a still larger machine, under similar conditions, which operated an arc lamp in the shops of the Taunton Locomotive Works. This machine was subsequently used as a motor to drive the blacksmiths' forge at the Schuyler Electric Works, at Hartford, Conn.

Mr. Wightman finished his education at the Polytechnische Hochschule, at Hanover, Germany, and returned to this country in 1884, when he immediately went to work in the factory of the United States Electric Lighting Company, at Newark, N. J. A few months later he entered the employ of the Schuyler Electric Company, of Hartford, Conn., and in the latter part of 1885 was made chief electrician of that company. He remained with the Schuyler Company until 1888, and during that time obtained, alone and conjointly with Mr. Herman Lemp, over fifty patents in thefield of arc and incandescent electric lighting.

MERLE J. WIGHTMAN.

Mr. Wightman's investigation of the early electric roads build by Siemens & Halske, at Berlin and Lichterfelder, Germany, convinced him of the future importance of the electric motor in the railway field, and in 1885 he applied for several fundamental patents in this field. He entered the employ of the Thomson-Houston Company, at Lynn, Mass., in 1888, for the purpose of developing electric railway apparatus, and took part in the design of all the early railway apparatus of that company, developing and putting into service the first series-parallel railway motor controllers. He was also associated with Prof. Elihu Thomson in the development of the single-phase alternating motor and the Thomson recording wattmeter. In 1890 he left the Thomson-Houston Company to organize the Wightman Electric Manufacturing Company, of Scranton, Pa., for which he designed a complete system of electric railway apparatus, and put upon the market the first successful single-reduction railway motor. In 1891, at the height of its success, the Wightman Company went under the control of the Thomson-Houston Company and was closed up, upon which Mr. Wightman was engaged as consulting engineer by the Steel Motor Company, of Cleveland, Ohio, and designed the motor and controller now manufactured by that company. Upon leaving the Steel Motor Company, he became consulting electrician of the Johnson Company, which position he now holds, and in which he is engaged in experimental work with a view to solving the underground conduit problem. He is also engaged in general electrical engineering work as consulting engineer and is interested in several street railway enterprises.

Isle of Man Electric Tramways.

The electric tramways which were opened in the Isle of Man in July, 1894, extended from Douglas across the hills to Laxey, the total length then being a little under seven miles, with a power station at either end. The power plant included vertical engines, Lancashire boilers and Manchester dynamos. At Grondle, about two and a half miles from Douglas, is an accumulator station containing 240 cells of the chloride type.

The line has so far worked satisfactorily in every way especially financially, and extensions are in hand for a distance of about four and a half miles. The new line is enthusiastically welcomed by the residents in the districts touched. The ruling gradient of the line will be one in twelve, and the curves are from ten to twenty chains radius. The whole of the plant for this extension is being supplied by Messrs. Mather & Platt, and consists of five 100-hp horizontal engines, five Mather & Platt dynamos and four Lancashire boilers of 150 hp each. The generating station is situated a few miles distant from the commencement of the line, and the accumulator station is at the Laxey station. The passenger cars used are to be 35 feet in length and to carry 48 passengers. The cars will be mounted on two four-wheeled bogies, and each axle will be driven by a separate motor; the whole equipment being capable of running the car at a speed of eight to nine miles an hour on the ascending grade. Each car will have two pairs of horizontal current-collecting wheels running on the centre rail system.

An Indiana Passenger and Freight Line.

For some time there has been talk of an electric railway to touch the chief places in Wayne, Union and Fayette counties, Indiana, and it has just been announced that the thing is assured. The terminals of the line will be at Richmond, and the chief places touched will be Connorsville and Liberty, the total distance being sixty five miles. Both passengers and freight will be carried, and it is estimated the cost complete will be $10,000 a mile. The section to be opened up is the finest in Eastern Indiana.

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HEILMANN ELECTRIC LOCOMOTIVE.

The discussion of the merits of the Heilmann locomotive by western members of the American Institute of Electrical Engineers shows that they are little inclined to view with favor this traveling power plant. The most favorable statement in reference to the locomotive was that it might prove to be a means of introducing electric traction on certain steam roads, and thus lead to the adoption of a system of operation dependent upon a central station. If the figures which were recently furnished by a French steam railway manager, at the International Railway Congress in London, are true, most railway companies will hesitate about experimenting with the Heilmann locomotive to any considerable extent, no matter what the cost may be. The weight of each of the two machines which are now being built in Paris will be 119 tons, or nearly 30 tons heavier than the most ponderous steam locomotive. There will be no great desire to test track construction and bridges with a fast-running machine of such a weight.

FEEDERS FOR STEAM LINES.

The success of the Nantasket Beach electric line, which it is now probably safe to assume, is likely to lead to a revival of projects for the construction of short line feeders for existing steam lines. All along the great trunk lines are found points at which it has long seemed to the local inhabitants advisable to construct roads of a few miles in length. In many cases companies have been formed to build the roads, but the enterprises have remained in abeyance, because the financial success of the ventures seemed doubtful. Many of these places have at the present time electric light plants, and in these cases it would be a comparatively easy matter to raise the capital necessary for the construction, when it is realized that an arrangement for renting power may be made. Many of these roads can be extended to local resorts and can attract enough business during the summer months to make the property lucrative. If one is warranted in drawing a conclusion from the list of incorporated companies which are weekly reported in the ELECTRIC RAILWAY GAZETTE, the next year or two ought to see the construction of a very considerable number of roads of this description.

ACCIDENTS IN BROOKLYN.

Recent accidents have caused a revival of the discussion of trolley car speed in Brooklyn. Why this city should suffer beyond other cities from accidents due to electric cars it is not easy to determine, but if common report is to be believed, such is the fact. It would certainly seem to be out of the question to reduce the speed below that now permitted by the municipal regulation. The existing rate is at present little better than that of the old horse cars, and it is unsatisfactory to all interests in the city, with the single exception of the elevated railway companies, whose business has greatly increased since the speed of surface cars has been limited to six and eight miles an hour. It would seem to be in order, if Brooklyn is to be as free from accidents of this kind as it should be, that a campaign of education should be begun for the purpose of instructing parents that the streets are not the proper playgrounds for children, and that some sort of precaution should be exercised by all those who cross the tracks. Knowledge of this sort should be possessed by the residents of a city which has had electric cars in operation for two or three years, but the reports of accidents would seem to indicate that Brooklynites are very largely ignorant of the very rudiments. If some means can be found to educate the people in this respect, and better discipline among motormen is maintained, the accident list should be reduced to such a point that it would be safe to resume a rate of speed such as the residents of other cities may enjoy when they patronize electric cars.

FRANCHISES OF THE NASSAU COMPANY VALID.

The action of an Appellate Court in New York State in affirming the validity of the franchises of the Nassau Electric Railway Company of Brooklyn, will tend to increase the confidence of the public in street railway properties. It will be seen that these rights, by the possession of which vast sums of money have been expended, cannot be lightly set aside. The decision of the lower court, which declared the franchise void, seemed to the laymen unnecessarily arbitrary and severe, both in respect to the company and the public. Acting upon the theory that it had obtained valid privileges the former had invested in Brooklyn a vast amount of money in construction and equipment. Its system was practically ready for operation when the decision of Judge Smith, before whom the suit was originally tried, caused a suspension of the work in all departments. Since that time the company has been losing the interest on the capital invested in the road, and the public has been deprived of the exceptionally good transportation facilities which the company was organized to provide. The finding of the Court would have seemed for these reasons exceedingly unfortunate even had it been entirely warranted by the facts. It appeared to the laymen as if some way should have been left open by which a compromise of the matters under dispute might have been effected, and the operation of the road might not have been seriously delayed. Judge Smith's decision set aside the franchises on the ground that they had been granted to the company as a matter of favoritism, and he held that greater compensation for the privileges might have been obtained from a competing company. This conclusion, the Appellate Court finds, the lower Court was not altogether warranted in assuming.

It is held that by virtue of their office the aldermen possessed the right to discriminate between the bids of rival companies and to accept that which appeared to them the more advantageous to the interests of the municipality. If a judge does not agree with the decision of the aldermen, he is not thereby warranted in overruling the franchise granted by the latter if corruption is not charged. If a judge should take such a course, the Court finds, he would be merely substituting his judgment for that of the aldermen, or in other words, assuming the functions which are delegated to the latter. By such reasoning the Court comes to the conclusion that Judge Smith was not warranted in setting aside the franchises of the Nassau Company, and this decision, as we have said, is likely to strengthen the confidence of the public in the value of street railways which depend upon franchises.

Pennsylvania Street Railway Returns for Last Year.

The returns from the street railways in the State of Pennsylvania for 1894, show a decided increase in the number of companies, cars, passengers, and consequently in receipts. There was a heavy increase in the funded and floating debts, cost of equipment and expenses, as compared with 1893, owing to the introduction of electric service on many lines. The passengers carried reached the enormous total of 302,334,449. The highest average speed maintained by trolley cars is 18 miles an hour, on the East Harrisburg line. The most commodious cars in the State are those of the Gettysburg line, whose cars seat 80 passengers. Their average speed is 15 miles an hour, and their value is fixed at $2,500. The total number of horses in use on the street railways of the State on June 30, 1894, was 6,034. In 1891 the number was 11,666. The Philadelphia Traction operated the greatest length of road, 181 miles. In 1891 there were 335 cars propelled by electricity in the State; in 1894 there were 1617, but several lines were in process of construction when the report was made up, so that the number of electric cars in use before the year closed was greatly in excess of the figures given.

The Lake Street "L" Abandons Humboldt Park Extension.

It has been stated on fair authority that since its settlement with the Metropolitan, the Lake Street "L" has abandoned its Humboldt Park extension, and sold a part of the right of way. For the portion of the right of way for the proposed extension, which the Lake Street Company secured, it paid out $500,000. When the company changed hands last year and came under the management of D. H. Louderback, the further purchase of property was discontinued, so that the entire right of way had not been secured. Besides the lots which were sold to the Metropolitan, it is said that an additional $130,000 worth of property has been disposed of, and the proceeds will go toward the cost of converting the motive power from steam to electricity.

Concerning the settlement with the Metropolitan, about which there has been much conjecture, it is said the Metropolitan people offered $100,000 in bonds or $85,000 in cash. The former proposition was accepted. From both transactions the company will realize about $225,000, the estimated cost of making the change from steam to electricity.

The Philadelphia Consolidation.

The proposed amalgamation of the Philadelphia, People's, and Electric Traction companies, to which reference was made in our columns last week, has been consummated, and the new company has filed an application for charter as the Union Traction Company. The basis on which the consolidation was effected is briefly as follows: It is proposed that the new corporation shall acquire the control by lease or by the purchase of shares of all the lines now forming the systems of the Philadelphia Traction Company, the Electric Traction Company, and the People's Traction Company, which include all the leading street passenger railway lines within the city of Philadelphia, except those of the Hestonville, Mantua & Fairmount Passenger Railway Company. The plan adopted provides that the property and franchises of the Philadelphia Traction Company shall be leased at a rental which will give each stockholder a net dividend of four dollars per annum on each share, payable in gold coin, free of taxes, this rental being measured at four per cent. upon a valuation of $100 per share for each share of Philadelphia Traction Company stock.

It is proposed that the Union Traction Company shall purchase practically all the shares of the Electric Traction Company at the rate of $85 per share for each share on which $50 has been paid, and $70 per share for each share on which $30 has been paid, and all the shares of the People's Traction Company at the rate of $76 per share. The price for the shares of the Electric Traction Company and the People's Traction Company will be paid in trust certificates, to be issued by the Pennsylvania Company for Insurances on Lives and Granting Annuities in form similar to those issued under agreement dated April 15, 1893, upon the shares of the People's Passenger Railway Company. These trust certificates are to be issued in sums of $1,000 each, redeemable at the option of the Union Traction Company after Oct. 1, 1945, with interest from Oct. 1, 1895, at the rate of 4 per cent. per annum, payable semi-annually on the first days of April and October in each year, said payments to be made in gold coin of the United States of the present standard of weight and fineness, free of taxes and all charges, and to be guaranteed by the Union Traction Company, and to be secured by a deposit in trust with the Pennsylvania Company for Insurances on Lives and Granting Annuities of all the shares of the stock of the Electric Traction Company and the People's Traction Company thus purchased.

The privilege is given to the stockholders of the Philadelphia Traction Company, the Electric Traction Company and the People's Traction Company, of subscribing to all the shares of the new company in proportion to their several holdings. This entitles each shareholder to subscribe to 77 per cent. of the number of shares held by him in the Philadelphia, People's or Electric Traction Company.

The boards of directors of the three companies have formally approved the plan, and the Philadelphia Traction board has called upon its stockholders for their assent in order to ratify the plan.

A most interesting feature of the deal is the statement, on excellent authority, that the trolley road to Fairmount Park will be built out of the proceeds of the first call of $3,000,000 on the stock of the Union Traction Company. The Fairmount Park Transportation Company is, it is stated, owned by the Philadelphia Traction Company, and, of course, it passes into the control of the Union Traction Company on the leasing of its owner.

With the privilege granted by the Park Commissioners, the right to grant it judicially declared, and the capital already in hand there would seem to be no further obstacles to be overcome or removed. The new traction company can build the road as soon as it pleases, and as the line is certain to be a profitable one, it will probably be built and opened to public use early next year.

On the two calls of $5 each per share on the stock of the Union Traction Company, amounting to $6,000,000, it is stated on authority that about $4,500,000 will be used for work now "in sight"; that is, for the building of the Park road, with its bridge over the Schuylkill River, and for finishing up work already under way. This will leave a margin of $1,500,000, and it is declared that there will be no further calls on the stockholders for money on their shares, unless for the purpose of building new lines not now contemplated.

The application for charter specifies the incorporators as follows: James McManes, Peter A. B. Widener and Wm. L. Elkins, of the Philadelphia Traction Company, who subscribed for 61,936 shares each; Thomas Dolan and George D. Widener, of the same company, 61,935 shares each; John Lowber Welsh, Wm. H. Shelmerdine and Caleb F. Fox, of the People's Traction Company, 51,613 shares each, and Jeremiah J. Sullivan, Alfred Smith and Alexander M. Fox, of the Electric Traction Company, 45,161 shares each, a total of 600,000 shares, of $50 par value each.

Decision Against the Philadelphia Traction Company Reversed.

The decision in the damage case of Tietz vs. The Philadelphia Traction Company, tried before Judge Reed in Common Pleas Court No. 3, in which the largest verdict at that time in a suit for personal injuries was ever given, was recently reversed by the unanimous decision of the Supreme Court of the State.

The case is in some respects a remarkable one. Tietz, who is a journeyman tinner, worked at roofing and cornice work. In August, 1892, while at work upon the roof of a two-story building, he fell to the ground, striking upon the brick pavement in the back yard of an adjoining property. When his fellow workmen reached him he was lying where he struck and was unable to move or speak. He was carried from the yard on a litter and taken to a hospital. Here it was found that both bones of one leg were broken and the bones about the ankle joint. He was also bruised about the head and body. When able to speak he complained of numbness or loss of sensation in the injured leg and in the back.

At the end of forty-four days he was able to move about with the aid of two crutches, and was discharged from the hospital in this condition. He continued to improve slowly for some three months and was able to lay aside his crutches. At this time, and before he had resumed work of any sort, he became a passenger on one of the company's street cars, and while upon the car a collision occurred. The jar occasioned by it did not jostle any other passenger from his position, but Tietz, who was standing on the rear platform, was thrown forward against the glass window in front of him and the skin was broken along the ridge of his nose by contact with the glass. No other injury was visible, or was complained of at the time. He then left the car and walked back to his home, a distance of half a mile or more. Suit was brought against the company for damages, and a decision rendered in favor of the plaintiff, awarding nearly $27,000 damages.

A New Electric Railway for London.

There was issued on June 22, in London, the prospectus of the Central London Railway Company, inviting subscriptions from the public for £2,850,000 in £10 ordinary shares. The directorate includes a number of prominent railway men, and the company has the advantage of the experience of Sir John Fowler, R.C.M.G., Sir Benjamin Baker, R.C.M.G., and Mr. J. H. Greathead as engineers.

The railway, which will be about six and a half miles in length, will be formed by the construction of two separate parallel tunnels throughout its entire length. It will have fourteen stations situated at various points in the metropolis. It is probable that this concern will later on be connected by means of subways with the Waterloo & City Electric Railway, which is now in course of construction under London. The prospectus anticipates that from 7,000,000 to 8,000,000 passengers will be carried annually. The engineers estimate the total working expenses of the line, with an electric two and one-half minute service of trains, may, as a maximum, be taken at £152,000 a year. All the carriages and stations will be lighted electrically. The Electric Traction Company, Ltd., has undertaken to provide land and construct and equip the line for £3,244,000, payable in cash and debentures.

In view of the fact that a similar line, the Great Northern & City, could not secure sufficient capital to allow it to go to allotment, when it only asked for £1,000,000, it is thought that the present company may have difficulty in securing nearly three times the sum.

Electrolytic Action from Trolley Currents.

The Albany Electric Railway Company has replaced, at a cost of $1,419.26, water mains in the vicinity of its power house which had been damaged by the electrolytic action of return trolley currents from its lines. In a communication addressed to the superintendent of the water works, Mr. George T. Bailey, the electrical engineer of the street railway company, Mr. Henry P. Merriam, explains the methods which have been adopted to prevent future damage, as follows:

"The remedy which has been applied for the prevention of electrolytic action of the railway current on water and gas pipes in South Pearl Street consists in providing a regular metallic path for the return current, leading from the underground pipes to the power station. It has been demonstrated that destructive action of the electric current is confined to those surfaces of the underground piping where the current leaves the metal, passing thence to the moist surrounding earth; the resulting decomposition of water sets free the oxygen to attack the metal. To prevent this passage of current from pipes to earth, heavy copper wires, connected to the negative 'bus' bar of the station switchboard, have been run along South Pearl Street 600 feet to the south and 3,000 feet to the north, with a branch running east through South Ferry Street to Broadway, a distance of 1,300 feet. At intervals along this route branch wires are connected, leading across the street and intercepting all gas and water mains. Each main is tapped and provided with a three-quarter bronze plug, which connects with the branch wires. The current, which it is impossible to prevent from returning to the neighborhood of the station by way of the street mains, is thus conducted into the station without the corrosion of lead or iron pipes."

The Speed Ordinance in Brooklyn.

The Brooklyn Heights Railroad Company began suit in the Supreme Court, on Thursday last, against the city of Brooklyn to have the ordinance limiting the speed of trolley cars declared void.

The ordinance, which was passed early in April, limited the cars to traveling not more than six miles an hour within two miles of the river front and City Hall, and eight miles in other parts of the first twenty-eight wards of the city.

The summons and complaint allege that Jan. 11, 1892, the city, by the Common Council, granted the company consent to change its motive power from horses to electricity. The company was privileged to operate its cars at a speed that would meet the requirements of the public, but was not to exceed ten miles per hour.

The complaint cites the fact that the present Board of Aldermen have sought to restrict the company from exceeding the six and eight mile limits, which, the complaint says, the city had no legal right or power to do in face of the grant of Jan. 11, 1892.

Hollow Steel Shafting.

Engines for electric railway power houses are subjected to very severe shocks in their use, and it is necessary that every precaution should be taken to prevent the breaking of their shafts. The ordinary solid wrought-iron shaft is made by hammering together, at a welding heat, small pieces of scrap iron, thus building up the shaft to the proper diameter and length, says the *Iron Trade Review*. Hollow steel shafting is made from an ingot which is cast in a vertical mould about twice the diameter of the finished shaft. The lining of this mould is perforated. While the metal is fluid it is subjected to a hydraulic pressure of 7,000 tons, which remains on it until the ingot is cold. This process of fluid compression completely prevents blow holes and cracks and makes the metal practically homogeneous. A sufficient volume of metal is cut off from this ingot to forge out to the length of the proposed shaft, and a hole the size of that in the finished hollow forging is bored through it. The piece is then reheated and a mandrill the size of the finished hole is run through it. It is then forged out to the necessary length under presses varying from 7,000 to 14,000 tons pressure, as may be required.

The steam hammer is not used in any of this work, as the blow is apt to produce only surface impact. After the forging is finished, it is placed in an annealing furnace and heated and allowed to cool slowly, thus relieving it of all forging strains. This shaft when finished is found to be very much better for use in places where shocks are liable to occur, and consequently it is coming into extensive use in the building of electric railway engines.

Continental Rules in Detroit for Electrical Railways.

An ordinance introduced at a recent meeting of the Detroit, Mich., council, provides that it shall be the duty of driver, motormen and conductors operating street cars, in approaching the crossing of any other street railway, to cause the cars to come to a full stop before reaching crossings, and at least twenty feet distant therefrom, and that a car shall not proceed further until the conductor shall have first preceded the same and reported by signal or otherwise the way to be safe and clear ; it is provided, however, that where the view of the approaches to crossings shall be clear, and unobstructed by any buildings or otherwise for a distance of not less than a hundred feet, it shall not be necessary for the conductor to leave his car. A fine not exceeding $300 for a violation of this ordinance is provided, and imprisonment not longer than six months if the fine is not paid. The proposed ordinance was laid over for action at a future meeting.

Comments and Views of Contemporaries.

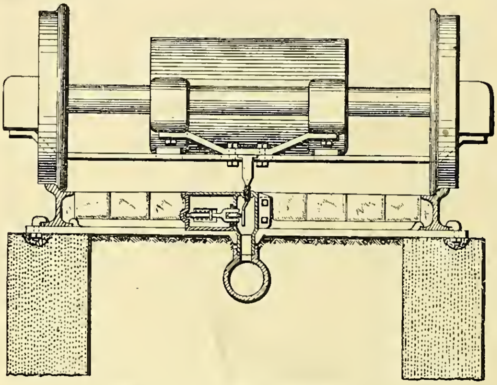
Wasted Opportunities.—There are now no less than 14 cities of the State which claim that they have near to their gates water-power of almost limitless capacity, which can be utilized at comparatively small cost for transmission of power by electricity. The probability is that every one of these claims is well founded. The wonder is that so few of them were preferred until after the success of the power transmission to this city.—*Sacramento Record-Union.*

A Feather for Binghamton Railway Company.—The Binghamtonians can congratulate themselves that it is the policy of the Electric Railway Company, of this city, to give the city the best service possible. That it does this is proven by the fact that, while it is obliged to run eight cars per day to Lestershire, it really runs 102 there. Other cities have cause to condemn their electric railway systems, Binghamton can do nothing but commend hers.—*Binghamton Herald.*

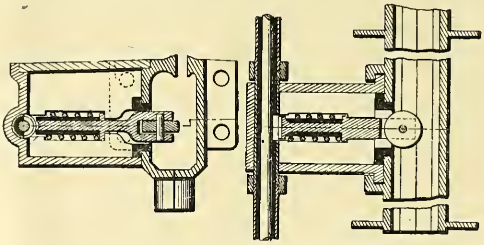
Substitution of Electricity for Steam.—What yet remains to be determined is the question whether electric propulsion can be maintained at the same or less cost than propulsion by steam, and whether as great stability can be assured in the new form of service as in the old. Of course, no general adoption of the electric motor can be expected until this point is definitely and satisfactorily determined. Railway companies will not discard the locomotives, which represent an investment of millions of dollars—the locomotive equipment of the New York Central alone is quoted at six millions and a half—so long as there is the least uncertainty as to the superiority of electricity to steam. We believe, however, that this will, at no distant day, be clearly established, and that with this demonstration will come changes in the methods and facilities of transportation which will not only immensely benefit all commercial interests but add largely to the popular convenience and comfort.—*Leslie's Weekly.*

Conduit Electric Railway.

We illustrate herewith a conduit electric railway system, for which a patent has recently been granted to Mr. Daniel O'Flaherty, a well-known civil engineer of Kansas City, Mo. The object of the system is to provide such a construction as will obviate the leakage of current, to which end a contact with the cable is made successively by connections interposed between the cable and a contact shoe depending from the car, the interposed mechanism being moved out of contact with the cable, when the pressure of the shoe is removed. In addition, the design includes provision for thorough insulation of all the working parts.


CROSS-SECTION THROUGH ROADBED.

Referring to the accompanying illustration, it will be seen that a shoe depending from the car strikes a contact roller, the shoe being of a length sufficient to be always in contact with two of these rollers, and at times with a third one. When the shoe strikes the roller, the spring-actuating rod carrying it is repressed, and the outer end of the rod forced into contact with the exposed portion of the feeder cable; a complete circuit is thereby obtained at all times, since the shoe, as stated above, is always in contact with two or more rollers. The contact rods and cable are contained in a recess in the conduit where they are not exposed to any flooding of water, all of the water entering the slot being carried off by a drain pipe located immediately beneath it. Other features of the system consist in the insulation of the shoe from the sides of the slot, and a very thorough insulation of the roller rods, and also in the conduit shell containing the cable into which the rod projects.


DETAILS OF CONTACT ROLLER AND ROD.

The Edwards Car Fender.

The accompanying illustrations show the improved Edwards car fender, which is made by Edwards & Co., Brooklyn, N. Y. This apparatus is simple in construction, and claimed to be durable and reliable. It consists of side bars, attached to the front platform of the car, to which are secured two frames bearing wire nets. The lower frame is arranged to tilt so as to form a picket, which holds the persons and prevents them from being thrown away from the fender by the force of the blow. Attached to the front edge of the tilting frame is a spiral spring, which forms a buffer and prevents the fender, when striking the legs of a person, from breaking the bones, and also prevents the front part of the fender from bruising the body. Fig. 1 shows the normal position of the fender when in use. Fig. 2 shows the position of the fender when catching a body. The swinging frame or platform of the fender is balanced and pivoted on two iron arms, the front part being slightly heavier than the back portion ; thus, after the person steps off the fender, the tilting frame assumes its normal position by gravity. This swinging platform can be raised or lowered any desired distance from the ground by a thumb screw under the forward arm.

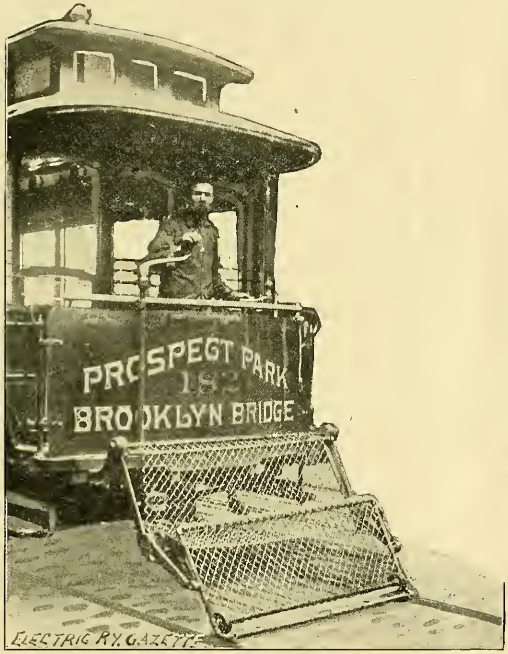


FIG 1.

If the car oscillates the fender rises and falls with the car, and cannot be injured, it is said, as the slight contact of the rubber roller with the ground, the weight being so light, raises it, but by its gravity it resumes at once its original position close to the ground. When a person is struck by this device he will fall, it is stated, as a natural result of the concussion, into the pocket of the fender, which is locked securely by an automatic latch, preventing the person from rolling out on the track in front of the car.

The fender, when not in use, can be folded very compactly, as shown in Fig. 3, against the dashboard of the car, and when so folded does not extend beyond the draw bar or buffer.

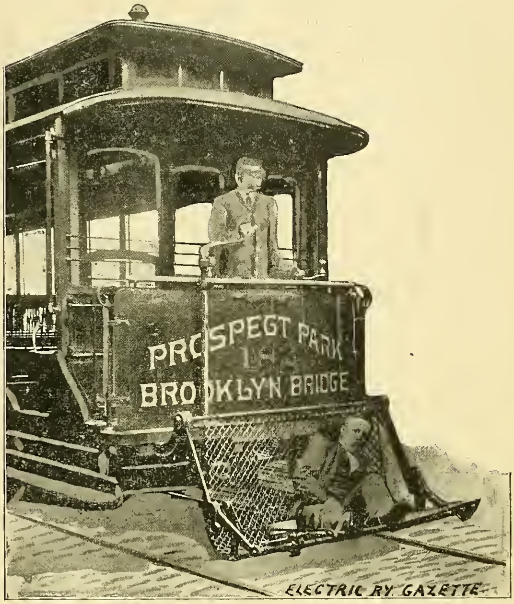


FIG. 2.

Numerous tests of the Edwards fender have been made on Brooklyn cars, and on one occasion the manufacturer of the device stepped in front of a car moving at the ordinary rate of speed, and was picked up unhurt, and without even a bruise.

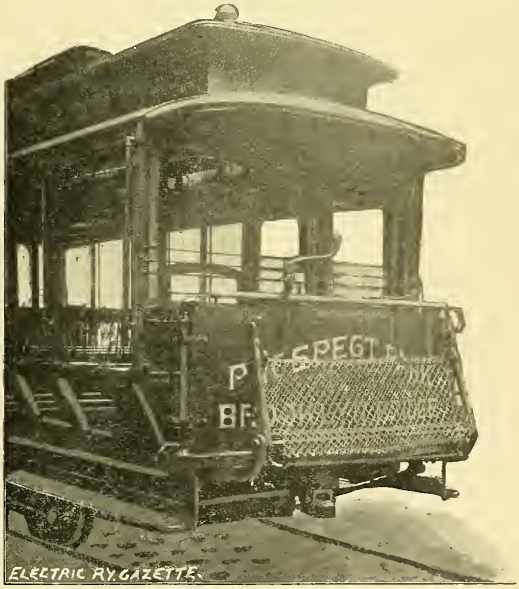


FIG. 3.

FINANCIAL NOTES.

ROME, N. Y.—The Rome City Street Railway Company has paid off its bonded debt of $125,000 and is now free from debt. Capital stock $50,000; amount issued $42,100.

PHILADELPHIA, PA.—The Philadelphia & West Chester Traction Company has authorized an increase of capital stock from $187,800 to $400,000 for the purpose of completing the road and putting it into operation.

BOSTON, MASS.—The $2,500,000 5 per cent. Lynn & Boston gold bonds purchased by the Bank of Montreal, in London, of Messrs. E. H. Gay & Co., of this city, were offered for public subscription in London last Monday, and the subscription books were closed, oversubscribed, at 2 p. m.

LOWELL, MASS.—The Lowell & Suburban Street Railway Company has petitioned the Massachusetts Railway Commissioners for authority to issue $400,000 additional stock for the purpose of reconstruction and equipping with electricity. The road is bonded to the extent of $1,000,000.

RECEIVER FOR ELECTRICAL ENGINEERS.—Judge Stover, in the Supreme Court, last week, appointed Duncan Edwards receiver in supplementary proceedings for Neftel, O'Connor & Co., electrical engineers, of 126 Liberty Street, New York, in a suit brought against them by John A. Roebling's Sons Company.

LITTLE ROCK, ARK.—The Pulaski Traction & Electric Company has filed a deed of trust in favor of the St. Louis Trust Company to the amount of $450,000 to secure 6 per cent semi-annual 20-year gold bonds of equal amount. This is for the purpose of providing the means necessary for the maintenance of the Little Rock Railway system.

CHICAGO, ILL.—The Chicago City Railway Company has decided to accept the Clark Street trolley ordinance and proceed under its terms as soon as possible to improve the street car service on that line. Three bonds, two of $10,000 each and one of $20,000, were left with the mayor for his signature. After receiving the mayor's approval they were filed with the city clerk.

CONSOLIDATION.—The stockholders of the Citizens' Street Railway, of Matteawan and Fishkill-on-the-Hudson, and the Fishkill Electric Railway have agreed upon operating the two roads as one. Following are the terms of the lease: That a lease for 20 years from Aug. 1, 1895, be made with the Fishkill Electric Railway Company, the Citizens' Company to guarantee the principal and interest on the bonds and pay the same dividend on the stock of the Fishkill Company that may be paid on the stock of the Citizens' Company. The receipts of the electric cars are more than one third greater than they were the corresponding time last season, this being due to the new line to Fishkill Village.

PHILADELPHIA, PA.—The decision of the Supreme Court rendered by Justice Mitchel in an opinion in the case of the city against the Thirteenth & Fifteenth Street Passenger Railway Company settles many long-disputed points. The city had notified the railway company to repair a certain part of Broad Street. The notices were disregarded, and the city then assumed the work of laying an asphalt pavement for the distance named from curb to curb of the street, and sought to collect the cost from the railway company, which refused to pay. A suit for this and other items was begun, and in the Spring of 1894 a verdcit was rendered in favor of the city for $148,000. The decision of the Supreme Court sustains that of the lower court.

FAIRMOUNT PARK ROAD.—President Judge Thayer has decided that there are no legal obstacles in the path of the proposed trolley line in the Park. In Common Pleas Court, No. 4, this week he handed down a decision in the equity proceedings of the city against the Commissioners of Fairmount Park, William Wharton, Jr., and the Fairmount Park Transportation Company. He dismisses the bill filed by the city and directs that the municipality pay the costs. The bill was brought to prevent the erection of a popular trolley road in Fairmount Park, and Judge Thayer's decision has the effect of setting aside the city's objection and permitting the erection of the road, which will open up connections with nearly every trolley road in the city, now that consolidation is consummated.

CARLISLE, PA.—The Harrisburg & Mechanicsburg Electric Railway Company has brought suit against the Cumberland Valley Railway Company. No statement was filed at the time, but it is reported on good authority that damages amounting to $50,000 will be claimed. Other suits, aggregating $75,000, will follow within a few days. The suits grow out of the attempt of the Cumberland Valley Railway to prevent the trolley company from completing its line to Riverton by obstructing the track extending from the People's bridge along the pike to Riverton, through which it goes to Camp Hill. The bridge of the Cumberland Valley Railway crosses the road on which the track is laid at Bridgeport, and last week the railway company, hearing of an intention to operate the unused track, dumped several hundred ties under it. In doing this the electric company's track was rendered useless for operating purposes.

PHILADELPHIA, PA.—An injunction has been applied for to restrain the Union Passenger Railway Company and its lessee, the Philadelphia Traction Company, from laying double tracks on East Susquehanna Avenue from East Thompson Street to Beach Street. East Susquehanna Avenue residents object strongly to the laying of a double track, claiming that there is not space enough in a roadway having only 26 feet between the curbs. Mr. Wm. R. Gardy, one of the petitioners for the injunction, said that up to July 25 it was thought that the Traction Company intended laying only one track. Work on laying one track was begun that morning at Memphis Street, where the East Susquehanna Avenue extension will connect with the York and Dauphin Streets branch of the Philadelphia Traction Company. Later in the day, however, a double set of rails was unloaded from that point down to Beach Street, and other preparations made for laying a double track, which elicited vigorous protests culminating in the application for an injunction.

TRACTION EARNINGS.—The gross earnings of Bridgeport Traction Company for the week ended July 28 were $4,604 greater than for the same week last year. For the first 20 days in July the earnings of Baltimore Traction increased $19,761, a daily average of $988, which is equal to $30,628 for the month. For the first 26 days in July the increase has aggregated $27,900, a daily average of $1,065, which is equal to $33,015 for the month. Earnings on the People's line also hold up well. On Saturday they were $6,728, an increase of $2,434, and on Sunday $8,223, an increase of $4,510. For the week ended July 27, the company's daily average earnings amounted to $6,797. This is somewhat below the average for the weeks immediately preceding last week. We give the daily averages for several weeks: June 1, $6,763; June 8, $6,614; June 15, $6,898; June 22, $7,123; June 29, $7,153; July 6, $6,711; July 13, $7,346; July 20, $7,207; July 27, $6,797. It may be well to note that the company is now comparing its earnings with a period when trolley cars were gradually displacing the old horse cars. Cars on the Fourth and Eighth Street lines began operation with electricity early in July, but only a few cars were put on at first, and the number gradually increased until a full complement was in operation. Present increases in the company's earnings, therefore, are all the more encouraging.

TROLLEY WAR ENDED.—The strife between Plymouth Township, Pa. and the Norristown & Chestnut Hill and Schuylkill Valley Traction companies was terminated on Wednesday, July 31, when the township supervisors withdrew the proceedings which had been instituted against the Chestnut Hill Company. Legal obstacles to the operation of the road sprang up more than a year ago, when one of supervisors annulled the franchise granted to the Chestnut Hill Company, on the ground that it had failed to complete its line within the time specified, and then granted a right of way over the same route to the Messrs. Shepp, who own a controlling interest in the Schuylkill Valley Traction Company. The Supreme Court sustained the lower court, and the Messrs. Shepp held the key to the situation in having acquired the franchise. Public sentiment, however, favored the Chestnut Hill road, and the Shepps, finding that their franchise was practically valueless, inasmuch as they could not obtain consent of all the property owners to occupy the public road, held out offers of a compromise. The first week in June the Chestnut Hill Company withdrew its cars, pursuant to the order of the court, and since then the negotiations that terminated to-day have been in progress. The supervisors unite in withdrawing permission to the Messrs. Shepp to construct a line and restore the franchise to the Chestnut Hill Company. The Messrs. Shepp receive a money consideration only, and the Plymouth township treasury is enriched several thousand dollars.

NEWS OF THE WEEK.

ENGLEWOOD, N. J.—It is reported that the Palisades Railway is to be extended to this place.

BURLINGTON, N. J.—A new trolley line is to be built on East Broad Street in the immediate future.

BUFFALO, N. Y.—The construction of an electric road from Buffalo to Chicago is contemplated.

ELIZABETH, N. J.—The Consolidated Traction Company will extend its trolley lines in this place.

LOCKPORT, N. Y.—The construction of an electric railway from this place to Olcott is contemplated.

MIDDLETOWN, N. Y.—Work has been commenced on the extension of the electric road in the north end.

BALTIMORE, MD.—The construction of an electric road from Franklin Road to Witheredsville is contemplated.

MIDDLETOWN, CONN.—The Middletown Electric Railway is to be extended from this city to Cromwell.

BROOKLYN, N. Y.—The Kings, Queens & Suffolk Railway Company will operate a bicycle railway on Long Island.

OLDTOWN, ME.—It is reported that an electric railway is to be constructed through to Great Works, from this place.

CLYDE, N. Y.—It is reported that an electric railway is to be built from this place to Bonnicastle in the near future.

ROME, N. Y.—The Rome City Street Railway Company has decided to relay its tracks on the Dominick Street Line.

FAYETTEVILLE, N. Y.—The Suburban Railway Company has been granted a franchise and will construct a road.

LEBANON, MISS.—A company is being organized for the purpose of building an electric railway to Bagnall, a distance of 75 miles.

ELIZABETH, N. J.—A franchise has been applied for to operate a trolley line up Morris Avenue through Sayer Street to Plainfield.

CHAUTAUQUA, N. Y.—The construction of an electric road from the Chautauqua Assembly Grounds to Barcelona is contemplated.

MEXIA, TEX.—A company is being organized for the purpose of building a railway from this place to Tehaucana, a distance of six miles.

TRIMBLEY, N. J.—A new trolley road is projected which is to run through Union County from this place across to Springfield and Summit.

WASHINGTON, D. C.—It is announced that work will begin at once on the construction of the Washington & Baltimore Boulevard Electric Line.

PITTSBURG, PA.—The construction of an electric railway from Chicago to this city is contemplated. W. A. Magee, of Pittsburg, is interested.

MONONGAHELA CITY, PA.—It is reported that an electric road is to be built from near Little Saw Mill Run to a point near Monongahela City.

GREENBUSH, N. Y.—The Albany & Greenbush Railway Company is to be incorporated, and will construct an electric railway through this place.

WASHINGTON, D. C.—The Anacostia & Potomac Railway is to be extended to Congress Heights and equipped with electricity. H. A. Griswold is president.

AUGUSTA, GA.—The Augusta Street Railway Company is contemplating the extention of its line to Lake Olmstead. D. B. Dyer can furnish detailed information.

FALL RIVER, MASS.—The Globe Street Railway Company has applied for a franchise to construct, operate and maintain an electric railway through certain streets.

OGDENSBURG, N. Y.—The Ogdensburg Street Railway Company has increased its capital stock from $75,000 to $150,000, and will convert its line into a trolley system.

GARDENVILLE, PA.—It is reported that an electric railway is to be built to this place. Simon J. Martinet is interested, and can be addressed for detailed information.

YEADON, PA.—An ordinance has been passed by the Borough Council, granting the Delaware County Railway Company right of way over certain streets of this place.

MANLIUS, N. Y.—An electric railway is projected between this place and Syracuse. Right of way is being secured. Major A. W. Wilkin can furnish detailed information.

BALTIMORE, MD.—The South Eutaw branch of the Baltimore Passenger System is to be equipped with electricity and operated as a trolley line. Walter S. Franklin is president.

LOWELL, MASS.—West Newbury has voted to appropriate $8,000 toward grading the new highway between Lowell and the ocean, along which it is proposed to build an electric road.

MILWAUKEE, WIS.—The South Milwaukee Advancement Association has expressed its willingness to render financial assistance to any company undertaking to build an electric road from here to Cudahy.

ANDOVER, MASS.—The Lawrence & Reading Street Railway Company is to construct and operate a street railway between the points named. Charles F. Woodword, of Wakefield, is interested, and can be addressed for information.

ELIZABETH, N. J.—The transportation of United States mail by the trolley line between this city and Newark is being discussed, and it is not improbable that an arrangement will be consummated for the establishment of the service.

ATLANTA, GA.—The Consolidated Street Railway Company will extend its line in various directions, including the extention of the Whitehall Street line to Fort McPherson, and the Peachtree Street line about a mile and a half northward.

MILFORD, MASS.—An electric railway, six miles in length, is to be constructed between this place and Medway, at an estimated cost of $100,000. C. W. Shippee and G. M. Green of this city are interested, and can be addressed for information.

NORFOLK, VA.—It is reported that the Norfolk, Albemarle & Atlantic Company is contemplating the changing of its line to standard gauge and equipping with electricity. D. P. Holland is superintendent and can furnish detailed information.

PONTIAC, MICH.—Work was begun this week on the electric power house for the Pontiac & Sylvan Lake Street Railway. It is located in the north part of the city, near the P., O. & N. depot. Wm. Fisher, of this city, is the engineer of the railway, and it is being rapidly extended to the lake.

QUEBEC.—The Quebec, Montmorency & Charlevoix Railway Company is acquiring the water power at Montmorency Falls, and have by parliament been given power to lease their surplus power and to enter into an agreement with the city of Quebec to construct and operate an electric street railway in that city.

DETROIT, MICH.—The Citizens' Street Railway Company will begin Monday to run its Woodward Avenue cars to the Michigan Central Depot, instead of down to the ferry wharves. The Crawford & Myrtle cars will be switched off Grand River Avenue, at Griswold Street, thence to Atwater and back to Grand River by way of Woodward Avenue.

PITTSBURG, PA.—An agreement has been arrived at between the Second Avenue Traction Company and the Pittsburg & Birmingham Traction Company whereby the two lines will be connected. There are only two squares to be covered, from South Thirty-sixth to South Thirty-eighth Street, and the work will be done this week. The fare from Homestead to any point in Pittsburg, by this transfer, will be 10 cents.

BOSTON, MASS.—A novel test of electric power is reported as having been made recently on the Nantasket Beach road. A heavy train, to which was attached a locomotive at one end and a motor at the other, was used for this purpose, and both engine and motor pulled together in opposite directions The electric motor pulled train and locomotive easily, despite the fact that the latter was under full head of steam and pulling against it.

BROOKLYN, N. Y.—The Canarsie Branch of the Flynn trolley system was opened Sunday. The first car over the route was started from the power house in 37th Street and 13th Avenue at 1.30 o'clock in the morning, and went over the entire Canarsie route. Albert L. Johnson, a brother of ex-Congressman Tom L. Johnson, the builder of the road, acted as motorman, and Secretary Fred. Cochey as conductor. About 50 cars were in operation during the day. They were all crowded.

CICERO, ILL.—The Town Board, by a 5 to 1 vote, has passed an ordinance granting the right of way to the Metropolitan Street Railway Company, of Chicago, from the east boundary to the west boundary of the town on Thirty-ninth Street, Thirty-fifth Street, Robinson Avenue and Lake Street. It also gives the company a right to build a line along the west boundary of the town from the north to the south boundary lines. The ordinance is to be in force for twenty years.

SOUTH FRAMINGHAM, MASS.—The route of the new electric road to Holliston and Milford from South Framingham has been determined. It will leave the South Middlesex tracks on Waverley Street, go via Cedar, Pine and Hollis Streets, to Holliston. Surveys are now making for the route, and the work will be rushed so that the road will be open as far as Holliston by Nov. 1. The Pierce Construction Company has the contract, and the capital for the enterprise is all subscribed.

CHICAGO, ILL.—It is reported that the Chicago & Northern Pacific will equip all its suburban lines with electricity, and that a new company, to be known as the Suburban Electric Company, will construct an extensive system of trolley lines along the C., B. & Q. to reach the towns of La Grange, Grossdale, Austin, Ridgeland, Oak Park and Lyons. The Town Board of Cicero has granted franchises for both enterprises, and their backers assert they will be pushed to an early completion.

HARTFORD, CONN.—The company which is to connect Hartford with New Britain by trolley is the Newington Tramway Company. E. S. Breed, the president, is also superintendent of the Central Railway & Electric Company, of New Britain. The road will be built under a charter granted in 1893, which would have expired on June 29. On June 28 the company was organized and accepted its charter. It is claimed that the new road will not parallel either the New York & New England or the Consolidated road. It is expected to have the road built by next Spring.

LOS ANGELES, CAL.—The Los Angeles Railway Company, which is the successor to the properties formerly owned or controlled by the Los Angeles Consolidated Electric Railway Company, and which embraces the large cable system of the Pacific Railway Company and Los Angeles Cable Railway Company, as well as numerous other lines, is now preparing to expend a large amount of money in betterments and in extensions of the main and allied lines. These improvements will then be followed by the complete change of motive power of the present 20 miles of cable road to electric power. The company is in the market for about 15 new cars of the double-truck style, with closed central bodies and open ends with longitudinal seats.

PHILADELPHIA, PA.—The Radnor Electric Passenger Railway Company proposes to build a road to be part of a continuous trolley line from Philadelphia to the National Park at Valley Forge, a distance of about 25 miles. The Radnor Company will form the link extendingf rom Wayne to Bryn Mawr and Rosemont, on the old Conestoga road, a distance of four and a half miles. The officers of the new Radnor Company are: President, Henry Douglas Hughes; secretary, Andrew J. Riley; directors, Messrs. Hughes and Riley and David Pepper, Jr., Alfred Layton, register, F. E. Schermerhorn, H. A. Mullen, F. A. Hawkins and Lincoln L. Eyre. The system as now projected starts at the city line, near Overbrook, and runs through Haverford, Merion, Narberth, Ardmore, Bryn Mawr, Wayne, Devon, Paoli and Berwyn to Valley Forge, with a branch to Conshohocken and Norristown. The plans are still in a somewhat formative state, and no date has yet been set for the beginning of construction. Eventually the several passenger railway companies which now make up the links of the proposed system will probably be consolidated in a traction company.

BALTIMORE, MD.—Contracts for constructing the Columbia & Maryland Railway, an electric road between Baltimore and Washington, a project in which P. A. B. Widener, William L. Elkins, Thomas Dolan and other prominent capitalists are interested, will be awarded next week, and work will begin soon on both ends of the line. It is estimated that it will take about a year to complete and equip the entire road. The portion of it between Baltimore and Ellicott City, it is said, can be finished in two or three months, as the Edmondson Avenue, Catonsville & Ellicott City Railway Company, which is a part of the system, has already constructed about six miles of road. The terminus of the road in Baltimore will be at Saratoga and Howard Streets, and a depot will be built in that vicinity. Leaving that corner, the road will extend by way of Saratoga, Monroe and Franklin Streets to the Calverton road, thence out Edmondson Avenue and through Nunnery Lane to Beaumont Avenue, taking up the private right of way secured by the company. Entering Washington, the line will traverse Rhode Island Avenue extended and North Capitol Street, to a connection with the car lines of that city. The line will be thirty-six miles long, and will pass through Catonsville, Ellicott City, Laurel and Hyattsville. It will be constructed with eighty-pound T-rails, laid on oak ties and stone ballasted. Standard railway construction will be maintained in building the line, which, it is said, is to equal in all respects a first-class steam road.

TRADE NOTES.

URBAN W. FRINK has been appointed Western manager for the A. W. Harris Oil Company, of Providence, R. I., with headquarters at 1325 Monadnock Building, Chicago.

REMOVAL.—The Electric Construction & Supply Company, formerly of 3 East Eighth Street, Wilmington, Del., has removed to 8 West Sixth Street, where larger quarters and better facilities will be enjoyed.

GEORGE K. HOOPER, who has represented the Abendroth & Root Manufacturing Company for three years as agent and engineer in Chicago, has resigned to accept a responsible position with the Deering Harvester Company of Chicago.

AFTER A PROLONGED TEST of two No. 5 Reliance columns, manufactured by the Reliance Gauge Company, Cleveland, O., the Boston Electric Light Company has adopted them, and has ordered 12 for the central station, 11 for the Ferdinand station, three for East Boston and two for South Boston stations.

F. P. MACK, Chicago, agent for William Sumner, who has succeeded to the business of the Underwood Manufacturing Company, of Tolland, Conn., claims that his house is entitled to the credit of having sold the largest belt ever placed in Chicago, which was one of a pair sold the Chicago City Railway Company, each of them being 198 feet long and 62 inches wide. These belts were placed in service in 1892, and have been in use ever since, transmitting 2,000 hp.

A NICE CATALOGUE is being distributed by the Lane & Bodley Company of Cincinnati, Ohio, containing detailed description and a quantity of well-executed illustrations of the Columbian-Corliss engines made by the company, which are exceedingly simple and strong in design. The frame is the box-section type, the most rigid for a given weight that it is possible to construct, and is cast in a single piece with the main journal pedestal and cross-head slide pedestal. The connecting-rod is of the solid-end type, dispensing with the strap commonly used, and affording much more reliable construction. Explicit directions are given for the erection of these engines, the adjustment of the valves and the care of the governor and its gear, and the catalogue closes with valuable suggestions to intending purchasers of engines, regarding the relative conditions under which various types are to be preferred.

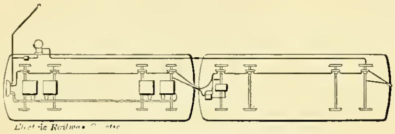
THE SHEFFIELD CAR COMPANY, of Three Rivers, Mich., has just issued a very attractive catalogue of its well-known railroad velocipedes and handcars. This catalogue is designated as "Special Foreign Edition," from the fact of its being printed in four languages—English, French, German and Spanish. The book is copiously and artistically illustrated. The issuance of this catalogue was deemed expedient in view of the very gratifying increase in foreign business. The Sheffield Company is now making a novel mining or tunnel velocipede, which has already worked itself into universal favor wherever it has been tried. This machine is designed for narrow-gauge tracks, and is so constructed that there are no projections extending beyond the track, so that it can be used in close quarters without any liability to hang in a narrow tunnel. The velocipede is intended for a single person, and is made for tracks of any gauge down to 17 inches.

A MASTERPIECE.—One of the most interesting, best executed and most intelligently prepared of advertisements is a book entitled the "Car-buyers' Helper," which has been issued by the Brownell Car Company, of St. Louis, Mo. The book is elegantly printed on good paper, handsomely illustrated and substantially bound in cloth. Many points are brought out upon which the average buyer is seldom posted, and the smallest details of construction are thoroughly explained. Particular attention is called to the merits of the "Accelerator" door arrangement, which consists of placing two separate doors in the end of the car, the one nearest the outside step being used. This disposition gives practically double the platform space available without obstructing the doorway. A most valuable feature of the book is a guide for the preparation of specifications, in which the smallest and apparently most insignificant parts of the car are considered. The purchaser is vigorously cautioned against cars built in extra short time, the rational argument being made that a car cannot be built from the start within the time required for proper painting, and still be a first-class job.

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED JULY 23, 1895.

543,042. TROLLEY WHEEL; Charles Mitchell, Yonkers, N. Y., assignor of five eighths to Harry A. Archibald, same place; filed Dec. 20, 1894. The trolley wheel has opposite side bearing frames with threaded bearing openings. Interiorly threaded bearing sleeves are fitted in the openings and are provided with interior annular V-shaped bearing grooves. The wheel is arranged between the bearing frames and is provided with central axle projections extended from both sides thereof and is exteriorly threaded. The interiorly threaded flanged insulator collars are fitted on the axle projections and bearing collars are fitted exteriorly on the insulator collars and provided with exterior annular V-shaped bearing grooves arranged opposite the grooves of the sleeves. Bearing balls are arranged in the space confined within the grooves of the sleeves and collars.



No. 543,351.—ELECTRIC BRAKE.

543,072. BRAKE SHOE; Charles F. Wohlfarth, Bloomfield, N. J., assignor to the Leppin Brake Shoe Company; filed March 28, 1894. The shoe has the metal at its extremities chill hardened through the entire mass in contradistinction to being hardened through only a fractional portion thereof. By this arrangement during the entire life of the shoe, the effects of abrasion are resisted by hard metal.

543,098. STREET CAR CURTAIN; John Kilgour, Cincinnati, O. App. filed Jan. 10, 1895. The frame consists of a pair of posts, with longitudinal grooves in their opposing faces. In the external wall of each groove there is a lateral passage, and chutes with descending passages, with inlets at the bottom, are secured to the outer sides of the posts and above the lateral passages.

543,130. UNDERGROUND TROLLEY SYSTEM; Noel B. Ginochio, New York, N. Y., and Henry C. Bridger, Woodbridge, N. J. App. filed Dec. 27, 1894. Switches are secured to the contact line, and comprise plates of insulating material with segmental contact points thereon. The levers have upwardly extending arms, and connections are made between the contact points and the main line. There are resilient electrical connections between the contact line and the lever, and these serve also as retarding devices for the levers.

543,151. CAR FENDER; Frank Goff, Camden, N. J., and Thomas H. Joiner, Burlington, N. J.; filed Jan. 2, 1895. An L-shaped supporting frame is connected with the car and is adapted to extend forward therefrom. An inclined fender frame is pivotally connected to the front of the supporting frame, and is normally arranged in an inclined position, with yielding connections between the fender frame and the brake mechanism, so that the frame will be cushioned and the brake automatically applied.

543,239. CAR FENDER; Saul Garlick, Brooklyn, N. Y. Filed Oct. 29, 1894. Rocking hangers are pivoted at their forward ends under the car and a fender is slidingly mounted in the hangers and adapted when slid in opposite directions to rock the hangers so that the fender is supported in different positions, while means for locking it in these positions are provided.

543,264. CAR FENDER; Daniel F. Nial, Troy, N. Y. Filed Nov. 23, 1894. L-shaped brace bars are pivoted at their upper ends and perforated near their lower ends and a fender provided with a border frame bent to an L-shape and with its front rail secured to the perforations in the extremity of the brace bars. Means are provided for holding the front edge of the fender normally above the track and contact with an obstruction on the track releases the fender.

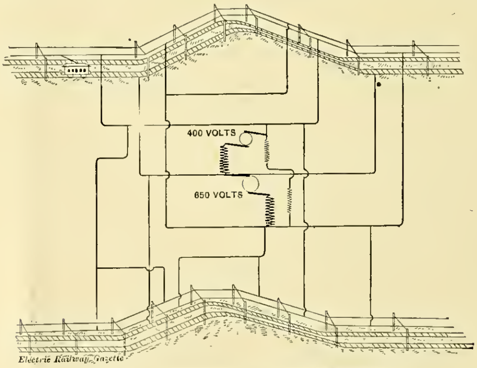
543,271. TROLLEY STAND AND POLE; Lawrence C. Seelye, Fort Edward, assignor of one half to George W. Burnham, Luzerne, N. Y. Filed Jan. 2, 1895. The trolley pole comprises oppositely arranged spring-pressed toggle arms, springs being secured to the opposite toggle arms and to an adjacent support. A device is actuated by the swinging of the toggle arms to disengage the springs and a lock alternately fastens the springs.

543,273. BRAKE SHOE; William W. Snow, Hilburn, N. Y., assignor of one half to the Ramapo Iron Works, same place; filed April 8, 1895. This is a cast metal brake shoe, with wearing surfaces to bear on those portions of the wheels which do not make contact with the rail, and with web portions uniting the bearing portions. It is provided with wrought metal strengthening portions extending through the web portions and into the bearing portions.

543,351. ELECTRIC BRAKE; William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York; filed March 23, 1895. The braking apparatus is applied to an electric motor car and a trailer. The brake is normally operated by the motors upon the motor car when operating as generators. An auxiliary normally idle dynamo-electric generator is carried upon or driven by the axle of the trailer, and suitable couples or connections are made between the braking apparatus and this generator so that the accidental separation of the connection between the motor car and the trailer acts to set the brake upon the latter. (See Illustration.)

543,352. SAFETY APPLIANCE FOR ELECTRIC CARS; Wm. B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York. App. filed April 9, 1895. A switch co-operates with the controllers and is adapted in its normal position to determine the direction of motion of the vehicle. There are contacts upon the switch arranged to connect the motors, each in an independent short circuit, and are arranged in two series, one designed to operate the forward motion of the car and the other its backward motion. Provision is made for interlocking between the controller and the switch, so that the former is free to move when the switch is in one or the other of its normal positions, and is locked against motion in its other position.

543,357. ELECTRIC TRANSPORTATION SYSTEM. Richard E. Sherman, Chicago, Ill. App. filed March 1, 1895. This is an overhead electric system designed for the transportation of mail. The outgoing and return circuit lines are supported one above the other on posts. A metal frame supports the mail bag and a driving contact wheel on the shaft is carried by the frame. An electric motor is provided on the frame insulated therefrom and from the mail bag receptacle. It has its armature shaft geared with the contact wheel, while an extension of the frame carries vertical guide rods. A second spring-controlled contact wheel is journaled to bear against the other lines on the shaft, with guide sockets surrounding the rods. An electrical connection is made through the motor between the contact wheels and the switch.



No. 543,405.—ELECTRIC RAILWAY SYSTEM.

543,382. ELECTRIC RAILWAY SYSTEM; John C. Henry, Westfield, N. J. App. filed May 13, 1895. The system of current distribution comprises one or more working conductors, divided into electrically separate sections, two dynamo-electric generators of different electromotive force coupled in series, feed conductors connecting the positive and negative sides of the coupled generators with different sections of the road and a neutral conductor connected with the generators in the three-wire or compensating system and common to all the road sections. (See Illustration.)

543,405. CAR FENDER; Oscar Rothrock, New York, N. Y. App. filed July 1894. The fender comprises a vertically movable receptacle arranged beneath the car end, controlling means extending above the car platform. A transverse flexible buffer is carried by the controlling means and is arranged in front of the dash, so as to protect pedestrians from the bumper or coupling head.

Electric Railway Gazette.

Vol. XIII. NEW YORK, AUGUST 10, 1895. No. 5.

Weehawken & Fort Lee Electric Railway.

The Weehawken & Fort Lee line of the North Hudson County Railway Company, of Hoboken, N. J., which, until recently, was operated entirely by steam locomotives, is now being converted into an electric road, and it is expected that trolley cars will, within a few days, cover the entire distance from Forty-second Street Ferry to Fort Lee. That portion of the line from Forty-second Street Ferry to Union Heights has been operated by electricity for some little time and from the latter point to Fort Lee steam dummies have been employed. The southern terminus of the road is at the West Shore Railway depot opposite the West Forty-second Street Ferry in Weehawken, from which place the road extends to the foot of the first spurs of the Palisades, and thence up an incline, three-quarters of a mile long, to the brow of the cliff. The maximum grade on this incline is seven per cent., with two curves of 40 feet radius each. From the top of the hill passengers are taken to Hoboken and Fort Lee and to the suburban district on the westerly slope of the Palisades. The company owns the entire right of way from Union Hill to Fort Lee with the exception of a section of about four blocks long in Guttenburg.

The road throughout has been practically reconstructed, and the work has been done in a very substantial manner under the supervision of A. K. Bonta, the electrical engineer of the company. Girder rails weighing 100 pounds to the yard are employed in the city, and the suburban tracks are laid with 76-pound T-rails. Rails are laid on oak ties and are double bonded with the Chicago rail bond.

The track on the suburban lines is stone ballasted throughout. Guard rails are employed on all curves, and on the incline from the ferry to the brow of the hill a heavy three-bar railing of wrought iron has been placed between the tracks and the wagon road to prevent accidents. Wood side poles and No. 00 trolley wire are employed throughout the line.

The current for operating the road is supplied by the Fourteenth Street power station in Hoboken, a description of which was given in the GAZETTE of May 4 last. For carrying the current, 26 miles of No. 0000 feed wire has been used.

The cars operated on the line are the old steam coaches which were rebuilt in the company's repair shops. Very little of the original cars, however, with the exception of the frames, remain. The car bodies are thirty-two feet in length, and the exteriors are painted cream color and are lettered and decorated in gold. The interiors are of mahogany finished in the natural color with bird'seye maple ceilings. Light is furnished by ten incandescent lamps arranged in two groups of five lamps each.

New Haven registers and Burrowes spring roller shades are employed.

The cars furnish accommodations for about 40 pas-

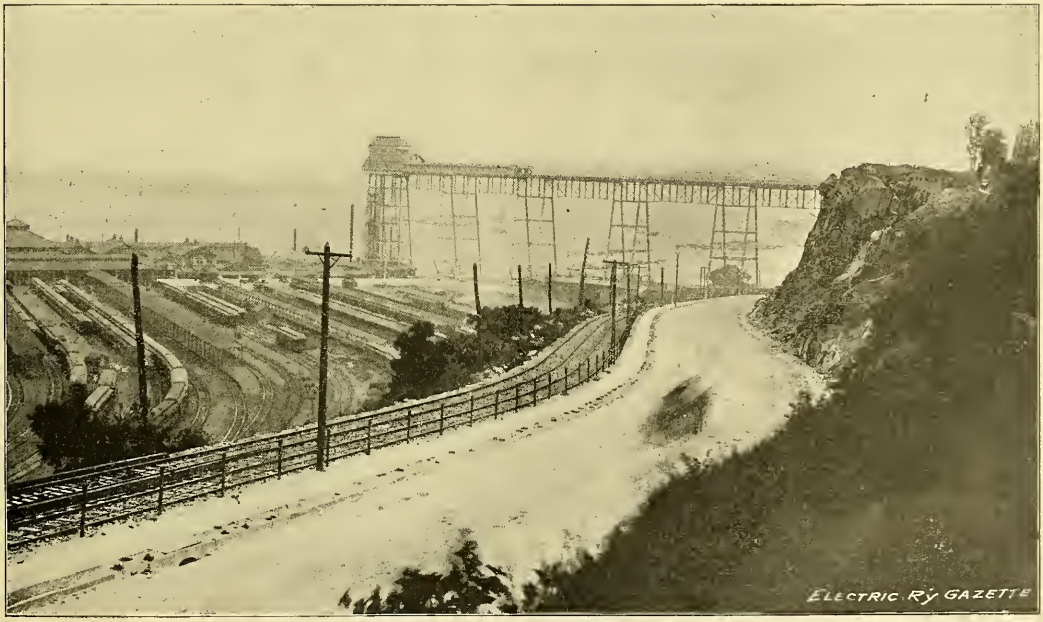


FIG. 1—ELEVATOR AND VIEW OF ELECTRIC RAILWAY FROM THE HILL.

sengers each. They are mounted on Brill maximum trucks and are equipped with two G. E. 1200 motors.

The trip from the ferry to Fort Lee is particularly interesting. For some distance the line extends along the top of the Palisades through one of the most attractive localities in the suburbs of New York and the view of the Hudson River and of New York City and the Bay, is highly picturesque. The cars run every twenty minutes and attain a speed of 35 miles an hour over the greater part of the line. The cars are equipped with the well-known Bonta electric safety brake in addition to powerful hand brakes. For a long time the ascent from the ferry to the top of the cliff could only be made by a long flight of wooden steps or by coaches plying over a very rough road. The increase of the suburban population in the vicinity led to the erection of an immense elevator at a cost of $500,000, which was connected to the top of the cliff by means of a trestle, Fig. 1.

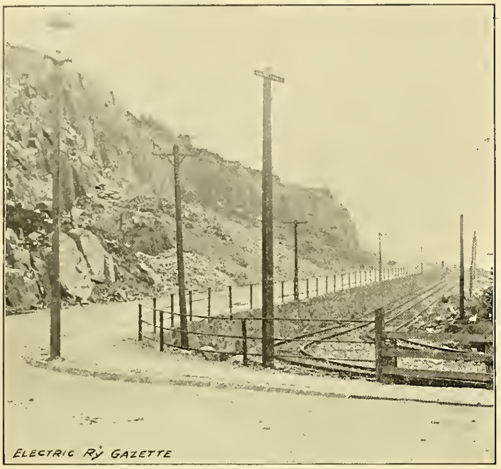


FIG. 2.—GRADE FROM FIRST CURVE.

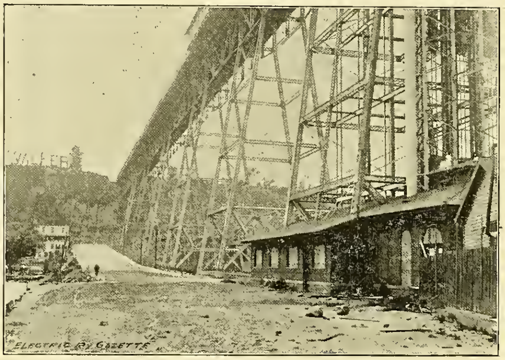


FIG. 3.—TERMINUS AT WEEHAWKEN FERRY.

There are three elevators of extra large size, each capable of lifting 200 people at a time. Even this provision did not prove adequate to the demands of the crowds arriving from the ferry or returning to New York after the Guttenburg races or the performance which was then given at Eldorado, a pleasure resort located on the cliff at the end of the trestle. At the time the elevators were put up the trolley system was not considered adequate to such grades as were presented by the steep and winding roads. Since that time, however, the company has equipped, electrically, the elevated line from the Barclay Street ferry in Hoboken to Jersey City Heights, and the road known as the Hillside line, running from the Fourteenth Street ferry in Hoboken to the Heights.

On each of the lines the grade is nearly equal to that of the Fort Lee road, and the operation of the electric cars has been so satisfactory that the company decided to build the present line and to equip the entire road to Fort Lee with electricity.

The entire work of rebuilding and equipping the road has been executed under the direction of A. K. Bonta. On one section of the road, 4½ miles in length, the entire work of changing from steam to electricity was completed in six days.

Accumulator Railways in Paris.

One of the several storage battery lines running from Paris to suburban districts is to be prolonged from the junction of the Boulevard de la Station and Avenue Du Nord to Pierrefitte. The department of state will give an annual subvention of 2,000 francs to assist the project. A concession has been asked from the Municipal Council of Paris for an underground conduit line from Place du Temple to St. Lazare Station along Rues Reaumur and Quatre Septembre.

Trolley Resolution Signed.

Mayor Strong on last Monday signed the resolution of the Board of Aldermen providing for the sale of the extensive railway franchise in the section above the Harlem River, New York, asked for by the People's Traction Company. The franchise, which must be sold at auction to the highest bidder, provides for an extensive system of lines which will probably be operated by the trolley system, and will cover about 27 miles of the streets in the Twenty-third and Twenty-fourth wards, providing a comprehensive system of street railways for extended sections of the city which are as yet scarcely developed.

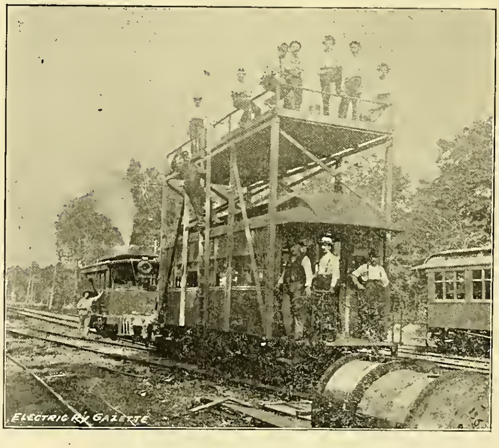
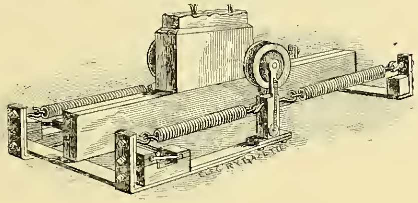


FIG. 4.—CONSTRUCTION TRAIN.

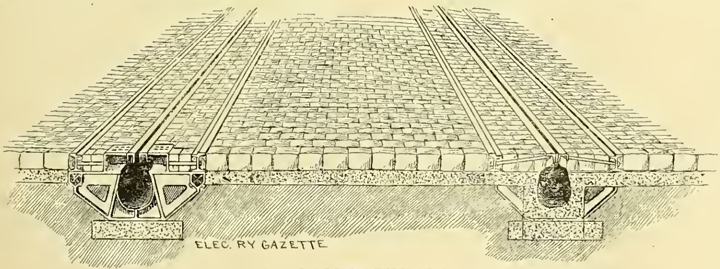
Electric Conduit System of the New York Third Avenue Company.

The Third Avenue Railway Company of New York has decided to install the Love electric conduit system on 2,300 feet of its road, extending on Tenth Avenue from 186th Street to 194th Street. The installation is made as an experiment. If it proves as successful as the company anticipates, the system will probably be adopted on a very considerable scale on the company's lines. Work has been begun on the equipment of the short stretch of track and will be finished in a few weeks. The line will connect at 186th Street with the company's Tenth Avenue and 125th Street division. The latter is operated by cable. Trailers will be transferred to and from the electric line at 186th Street, and passengers will be enabled to ride from the postoffice to 194th Street for a single fare and without changing cars.



TROLLEY.

The conduit construction will be similar to that of the 125th Street cable line of the Third Avenue Company. It is practically the same as that employed in the Love conduit construction on the Rock Creek electric line in Washington, D. C. A few changes have been made to adapt it the better to the conditions existing on Tenth Avenue. A complete metallic circuit will be employed and current will be distributed at 500 volts. The yokes are of cast iron and will be spaced about 4½ feet apart. They are set on concrete foundations which are six inches in depth and concrete is also used on the sides of the conduit. The conduit lining is cast iron. The slot rails are of an inverted U shape, the lip next the slot being of greater length than the other lip to protect the conductors from water or pieces of metal which might fall into the conduit.



TRACK CONSTRUCTION.

The conductors are copper bars, with curved flanges top and bottom. They are in lengths of 14½ feet, and the ends of those forming the same side of the circuit, instead of being butted, overlap each other for a distance of six inches, forming the expansion and contraction joint. The two channel bars are held together here in spring contact by a bolt, which passes through an elongated hole in a brass plate riveted to each channel, thus permitting the necessary freedom of motion from heat and cold.

The conductors are supported from the yokes only at the joints, so that the insulators on each side are located 13 feet apart. The insulator, which is supported from the yoke, is not connected rigidly to it, but rests upon two horizontal rods, so that it can move in the direction of the conductor, backward or forward, while resisting motion in any other direction. The insulator clip is brass, and the insulating compound is of the Johns asbestos type.

At each insulator is a special yoke cast with a hand hole, so that access to the insulator and joint is made as readily as possible. A drip shield prevents water, which leaks around the cover, from reaching the insulator. From the hand hole the bolts holding the slot rail in place can be loosened and the slot rail can thus be readily removed if desired.

The trolley, which is shown in the illustration, carries two wheels which run along the under side of the conductors. Each wheel is held in a swinging bracket and supported in a vulcanized fibre frame and is pressed against the conductor by spring contact, no matter in which direction it may be going. The lead wires are taken up to the car between steel plates.

The six cars to be operated on the line will be reconstructed horse cars. They will be mounted on Peckham trucks and will be equipped with General Electric motors. The entire insulation is being made under the supervision of Major G. W. McNulty, who has charge of the engineering department of the Love Electric Traction Company.

The site for the power station has not been selected, but as the plant will not be large it can be installed in a short time. It is hoped that cars will be in operation during October.

Railway Cars on Country Roads.

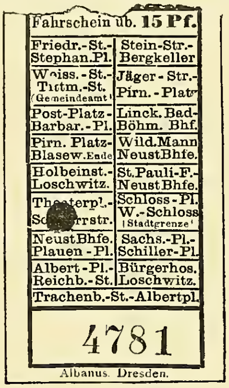
Martin Dodge, writing in the *North American Review* says: "I advocate an important and far-reaching change in the manner of building country roads. My plan is to extend the street car tracks from our cities out into the circumjacent territory a distance of thirty or forty miles, so that all the territory between centres of population sixty or eighty miles apart would be reached. Let these tracks be so made and laid that wagons and carriages propelled by horses may go upon them, as well as cars propelled by electricity or other inanimate power. It is already demonstrated that only one eighteenth of the power is required to move a vehicle over a smooth steel rail that would be required to move it over a gravel road, or one eighth of that which would be required to move it over the best pavement. When this important fact becomes generally known to the farmers, they will realize that it is a poor policy to promote the building of macadam roads when an equal outlay would provide a good steel track. When the track is once provided so that cars and carriages propelled by horses can also go upon the same tracks with cars propelled by electricity, the superiority of the inanimate power will be so apparent that horse-power will be quickly abandoned, and what we have seen in roads, namely, a complete substitution of electric power for horse-power wherever the rails are laid.

European Street Railway Tickets.

BY ROBERT GRIMSHAW.

In various communities there exist local differences which call for great variety in fares, exchange tickets, systems of inspection against peculations by the employees and by the passengers, etc. In some cities the ticket system is very simple, in others complicated; in some the inspection is rigid, in others the companies have found that inspection was either unnecessary or unprofitable.

It might be interesting for our readers to compare the tickets and systems of inspection and collection employed in some of the leading European cities with their own, and, bearing these in mind, we give herewith samples of text and translations thereof, taken from the tickets in use in Dresden, Germany, and Paris, France.



Fahrschein üb. **15 Pf.**	
Friedr.-St.- Stephan.Pl.	Stein-Str.- Bergkeller
Weiss.-St.- Tittm.-St. (Gemeindeamt)	Jäger-Str.- Pirn.-Platz
Post-Platz- Barbar.-Pl.	Linck.Bad- Böhm. Bhf.
Pirn. Platz- Blasew.Ende	Wild.Mann NeustBhfe.
Holbeinst.- Loschwitz.	St.Pauli-F.- NeustBhfe.
Theaterpl.- Sc[illegible]rrstr.	Schloss-Pl. W.-Schloss (Stadtgrenze)
NeustBhfe. Plauen-Pl.	Sachs.-Pl.- Schiller-Pl.
Albert-Pl.- Reichb.-St.	Bürgerhos. Loschwitz.
Trachenb.-St.-Albertpl.	
4781	

Albanus. Dresden.

EXCHANGE TICKET USED IN DRESDEN.

In Paris, omnibuses are much more common than tramways, the "Compagnie Générale des Omnibus" having enough lines of omnibus to use up more than the letters of the alphabet to designate them (A, B, C, etc.), the tram-lines being designated by a capital T and similar letters, as TA, TB, etc. The fare is usually 30 centimes (six cents) for seats inside and on the platform, and 15 centimes (three cents) for the *impériale* or upper story (in nearly all cases uncovered). For single fares above or below no tickets are issued, but exchange tickets (*correspondances*) are given between the various lines for the 30-centimes fare, when called for. In order to prevent these tickets being transferred or used twice by the thrifty Parisians, they are printed with the initial of the issuing line, and each bears impressed on it the number of the issuing omnibus, and the hour and minute (to five minute-intervals) when the fare was paid. The text on these tickets, which are of stiff cardboard, may be translated as follows:

"Inside Ticket T. V.

"Exchange can be demanded only when fare has been paid.

"The passenger loses his right to exchange if he quits the station where he should change, or if he does not reply to the call of his number.

"The ticket is only valid if it bears the date, and the number of the omnibus. *Exchange is not guaranteed.*"

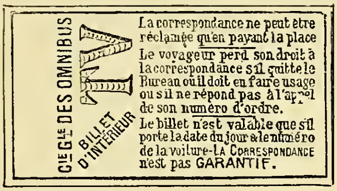
The reference to the "call of the number" of the passenger demands explanation. At each regular omnibus station (and there is no exchange permitted except at such regular stations) there is an employee who gives each person who comes there and demands it (whether he have a ticket or not) a consecutively numbered ticket, of a color corresponding to the line for which it is issued, and the direction. The omnibuses being permitted to carry only so many passengers inside, so many on the rear platform and so many on top (say 14, 5 and 20, respectively), and the sign "Complet" (full) being displayed when all these places are full, the numbers which are out are called in rotation and the holders take places where they prefer. As each section is filled that fact is so announced, and when there are no more unoccupied seats (or standing places on the platform) the next must wait their turn on the next vehicle (if there is one). In fine weather those with "correspondances" usually prefer the "imperial," where it is less close, and where smoking is permitted. This compels those new passengers (with higher numbers) who had intended, from economy or preference, taking the "imperial" to go below and pay 30 centimes instead of 15, or to wait for the next 'bus. Conversely, when in wet weather the low-number passengers fill the interior, those with higher numbers must either go upstairs, save their 15 centimes and get wet, or wait for another 'bus.

The "Complet" system has its advantages and its disadvantages—the latter coming out most prominently in wet weather, with parties of several persons, and with the last omnibus.

In Dresden, Germany, there are two street railway companies having red and yellow cars respectively. They do not exchange with each other; and one of them has no exchange tickets between or among its own lines. The first of these issues tickets like that shown in No. 2, different colors being used for the different denominations. The one shown is for 10 pfennigs (2½ cents), and calls for a ride between any two of the seventeen pairs of points indicated in the compartments; as from Friedrich Strasse to Stephanien Platz, or from Weisseritz Strasse to Tittman Strasse, etc. All of these pairs of points are not on the same line, one form serving for all the lines of the same company. The conductor punches the compartment indicating the "*strecke*" or stretch for which the passenger has paid. Each ticket bears at the bottom its consecutive number up to 9999, and in tinted ink, across its face, the initials of the line.

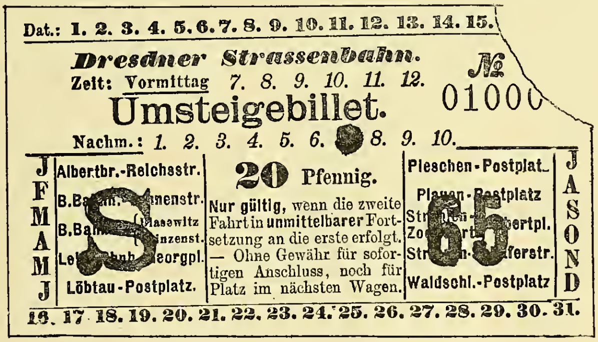
The other Dresden line has similar tickets in that the various "*streckes*" or stretches between pairs of points are indicated in compartments and are punched out by the conductor; the serial number is given at the side, the denomination given, and the various denominations indicated by the color; but in addition there is the caution "good only for the punched-out stretch" (or "reach," or "section," as the word "*strecke*" may be variously translated). Also there is the notice, "to be kept during the ride"; this being by reason of the system of inspectors who board the cars at regular intervals and take the number of the passengers' tickets, comparing them with those in the conductors' books. The consecutive number of the ticket in the series of 99,999 is given at the left, and the series-letter and number are printed in tint across the face of the ticket.

This line issues exchange tickets or "Umsteige Billets" (and, by the way, it is to be noted that while it retains the French word "*billet*" on these, it calls the plain ticket a "*Fahrschein*," or "ride-certificate," in accordance with the latest German usage, which discards French words or those of French origin when a genuine Teutonic expression can be found—or made).

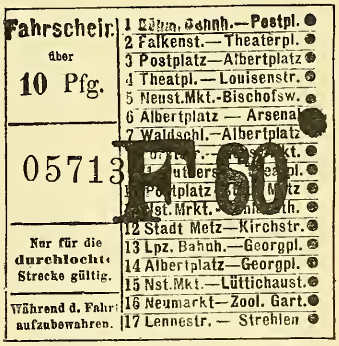

CIE GLE DES OMNIBUS
BILLET D'INTÉRIEUR
La correspondance ne peut être réclamée qu'en payant la place
Le voyageur perd son droit à la correspondance s'il quitte le Bureau où il doit en faire usage ou s'il ne répond pas à l'appel de son numéro d'ordre.
Le billet n'est valable que s'il porte la date du jour & le numéro de la voiture-LA CORRESPONDANCE n'est pas GARANTIE.

EXCHANGE TICKET USED IN PARIS.

These exchange tickets are complicated affairs. Besides the name of the company, the series-letter and number, and the consecutive number in the series, they bear the list of "sections," the denomination (20 pfennings, equals five cts.) and the text "Only valid when the second ride follows at once after the first one. Without guarantee of immediate continuance of ride, nor of a seat in the next car." At each side are initials corresponding to the names of the months; along top and bottom are 31 numbers for the days of the month; and there are also two lines giving the hour-numbers, 7 to 12 inclusive, and 1 to 10 inclusive. In the right hand upper corner is a line marking off a triangle marked, "To be torn off by the second conductor." This ticket, then, has to be punched for the road-section, and for month, day, and hour. No exchange tickets are issued after 10 p. m., nor on Sundays nor other holidays. But as for most rides there is no saving in the purchase of the exchange ticket, that makes no difference except in the matter of the five-pfennig "tip," which custom gives to the conductor with each fare, especially when change has to be made, but not when an exchange ticket is tendered. (The conductor who is "tipped" salutes in military style, and says "best thanks"; and when you leave the car is careful to say "adieu.")


Dat.: 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15.
Dresdner Strassenbahn.
Zeit: Vormittag 7. 8. 9. 10. 11. 12.
№ 01000
Umsteigebillet.
Nachm.: 1. 2. 3. 4. 5. 6. [illegible] 8. 9. 10.
J F M A M J
Albertbr.-Reichsstr.
B.B[illegible]nenstr.
B.Ba[illegible] Masewitz [illegible]inzenst.
Le[illegible]eorgpl.
Löbtau-Postplatz.
20 Pfennig.
Nur gültig, wenn die zweite Fahrt in unmittelbarer Fortsetzung an die erste erfolgt. — Ohne Gewähr für sofortigen Anschluss, noch für Platz im nächsten Wagen.
Pleschen-Postplat_
Pla[illegible]-[illegible]stplatz
Str[illegible]ertpl.
Zo[illegible]rt
Str[illegible]ferstr.
Waldschl.-Postplatz
J A S O N D
S 65
16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31.

EXCHANGE TICKET USED IN DRESDEN.


Fahrschein
über
10 Pfg.
05713
Nur für die durchlochte Strecke gültig.
Während d. Fahrt aufzubewahren.
1 [illegible] Bahnh.—Postpl. ●
2 Falkenst.—Theaterpl. ●
3 Postplatz—Albertplatz ●
4 Theatpl.—Louisenstr. ●
5 Neust.Mkt.-Bischofsw. ●
6 Albertplatz — Arsenal ●
7 Waldschl.—Albertplatz ●
[illegible]kt. ●
[illegible]uters[illegible]pl. ●
[illegible]Postplatz[illegible]tz ●
[illegible]st.Mrkt.[illegible]th. ●
12 Stadt Metz—Kirchstr. ●
13 Lpz. Bahnh.—Georgpl. ●
14 Albertplatz—Georgpl. ●
15 Nst.Mkt.—Lüttichaust. ●
16 Neumarkt—Zool. Gart. ●
17 Lennestr. — Strehlen ●
F 60

EXCHANGE TICKET USED IN DRESDEN.

On the back of the "Umsteige Billet" there is printed the following:

"This exchange ticket is good for one ride to one point of destination, on two connecting lines. The change of cars must take place at the first opportunity. (See the map.)

"The exchange ticket is not valid on Sundays and holidays, nor after 10 p. m. on week days, except on the sections between Pirnaischer Platz and Tolkewitz Cemetery, and Prinzenstrasse and Tolkewitz.

"Its use is not permitted where the fare on either section alone is as high as 20 pfennigs."

As by most of our street railway and omnibus lines tickets (except for "exchanges") are not issued, control being effected by other means, the following anecdote, said to be literally true, may prove as appropriate as amusing.

One of the principal proprietors of the now-extinct "stages" in New York City was "Hank" ———, who numbered among his drivers (conductors there were none) some rather tough specimens of humanity. In those days the principal requisite in a stage-driver was that he should be able to see all passengers wishing to get aboard his craft, and to pilot the latter through (or over) all obstacles—of which there were many. "Knocking down" to a moderate extent was assumed by driver and proprietor as a matter of course, the latter counting on the former to lose no opportunity of getting a passenger and of getting his fare out of him, so as to give him leeway for a limited percentage of peculation and yet keep the line on a paying basis.

But one of the drivers on "Hank's" line seemed rather too grasping; and as the motto "where ignorance is bliss, 'tis folly to be wise," did not seem to apply in this case, he was pretty carefully watched, from the time he gathered up the reins until he made his returns to the cashier.

On one occasion he was followed into an out-building whither he went before turning in his cash; and the watcher saw him very methodically dividing his receipts into two equal parts, by the very simple operation of sliding the pieces of equal value to alternate sides of the bench which he straddled, with the comment, as each piece went to right or to left, as the case might be: "One for me and one for 'Hank;' one for me, and one for 'Hank,'" etc. At the end there remained an odd dime, concerning which he said, audibly, to himself, "I guess I'll toss 'Hank' for that! Heads for me, tails for 'Hank'!" It fell tails up. "Well, I guess we'll make it 'best two out of three.'" By this late chance the last dime fell to the driver.

On presenting his returns he was very promptly informed that his services were no longer required. "Why so?" asked he. "Well," said "Hank," "I don't think you gave me a fair show for those last ten cents!"

Renewing Worn Steel Rails.

A few weeks ago, the Pioneer Rail Renewing Company, of Chicago, leased a rail mill of the Illinois Steel Company, and has since been experimenting with a process of renewing steel rails worn in service. The process is that of Elb. McKenna, general superintendent of the Great Northern Railway Company. It is asserted that the experiment has been entirely successful, and the works have now an output of 100 tons daily, running on a single turn. The opinion that the steel would be improved by proper reheating and re-rolling seems to have been verified by fractures of the same rail before and after treatment. It appears that the steel is changed from a coarse-grained structure to a fine, close-grained one, the difference being perceptible to the eye. The following description of a visit to the mill when it was running on Michigan Central rails that originally weighed 65 pounds to the yard, but which had lost about a pound by wear and oxidation, is taken from the *Railroad Gazette*. The rails were of the old standard Michigan Central section, and were re-rolled to the Hawks, or American Society of Civil Engineers section, 58½ pounds per yard.

The furnace is of the reverberatory type, 35 feet long, with grates on one side at each end. They are fired with bituminous coal, a "green" fire being used, and forced by a blast from beneath the grate. Above the grate the flames meet a hot blast to increase the combustion. This blast is treated by passing the cold air through a heater in the furnace and meets the flames before they pass the bridge wall. The amount of air is regulated by a valve in the cold air main, the proportion of air to be directed between the cold blast beneath the grate and the hot blast above the grate being determined by valves placed in the pipes just before it reaches the furnace. The length of the furnace being 35 feet leaves a distance of 2½ feet between the ends of the rail and the furnace doors. This insures the rail from contact with air that might enter by the doors and therefore presents loss of weight to oxidation.

In this process it is absolutely necessary to heat the rail uniformly, and the length being 30 feet it was quite a problem to do this. However, by the construction of the furnace and the handling of the fires this has been accomplished very satisfactorily, and the rail on leaving the furnace is of a uniform cherry red about 1,200° Fahr. It was also desired to roll the rail at as low a temperature as possible in order to prevent undue oxidation and better the character of the steel. As high a temperature is not needed to re-roll the rail as was necessary in the original rolling on account of the fewer number of passes through the rolls.

About ten rails are now charged into the furnace at one heat, and the time of heating is about fifteen minutes, but it is expected to reduce this to ten minutes. The furnace having doors at each end, as fast as a rail is withdrawn from one end, another rail is charged from the other end. The devices for charging and withdrawing the rail are the invention of Thos. S. Blair, Jr., general manager of the mill, and are exceedingly neat mechanical arrangements. The charger consists of two channel beams placed with their flanges on the outside, and enough room between them for a rail to rest upright on rollers carried between the channels. They are mounted on wheels, which run on a track extending from the rack on which the old rails are placed to the furnace, and there is a small steam engine mounted on a carriage placed at the end of the channels remote from the furnace. This engine serves the double purpose of running the charger on the track and also of shoving the rail into the furnace. The motive power is obtained by gearing, and a carriage running on the channels shoves the rails from the charger into the furnace. A chain fastened to this carriage and driven by a sprocket wheel on the engine moves the carriage forward and back. On the front end of this carriage is a projection long enough to shove the rail the necessary distance into the furnace. The device for withdrawing consists of a carriage long enough to allow the rail to rest its length on it, and having two endless chairs with bars between them for carrying the rail. An engine similar to that on the charger withdraws the rail and also moves the carriage on a track from the furnace to the rolls.

After arriving at the rolls, the chains in the carriage are reversed and the rail is run into the rolls. Before entering the rolls it meets two revolving wire brushes that remove the scale. But two passes are made, the first, compressing the rail about three-tenths inch, fills out the worn places, and leaves only a light finishing pass to complete the re-rolling of the rail. Before entering the rolls for the finishing pass, two steam jets remove the remainder of the scale which would interfere with a good finish being put on the rail.

After passing through the rolls the rough ends are sawed off, in most cases inside of the first bolt holes. New holes are then bored, and the remainder of the process is like that in an ordinary rail mill.

About two feet is gained by elongation, though some rails are so badly worn as to necessitate the cutting off of a greater length. The finished rails are of as good appearance as the best new rails and can be replaced in main track. By this means a considerable saving is secured by railway companies, the exact amount, of course, being dependent on the price of new rails. The cost for renewing the rails is $5 per ton, as against a cost of, say, $25 per ton for new rails. This, however, does not represent a gain of $20, as old steel rails have a value of about $10 per ton when cut off and used for laying in main track or side track, and as scrap steel. This cost of $5 per ton does not include freight charges, as the rails are delivered on the cars at the works of the Pioneer Rail Renewing Company, and the railway companies pay the cost of hauling both ways; but, on the other hand, a part of the freight charges would be offset by the cost of hauling the old rails to and from shops for resawing.

Baldwin-Westinghouse Electric Locomotive.

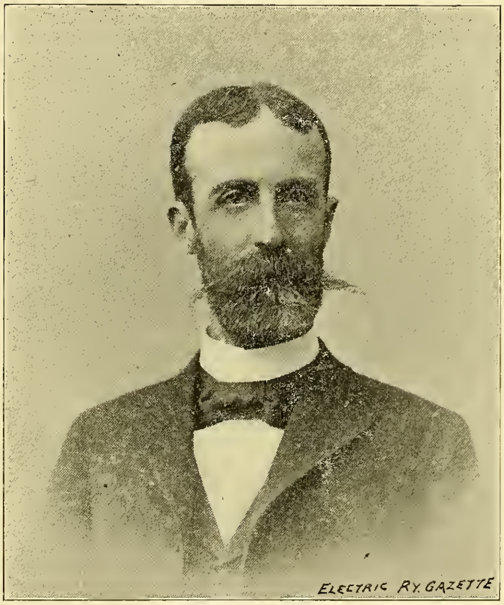
It it stated that the draughtsmen in the Baldwin Locomotive Works are now working on the plans for the new electric locomotive which that company intends to produce. The new completed locomotive will be ready for inspection, it is announced, in about three weeks. Two trucks will be made—one for light work and elevated roads, the other for the heavier class of suburban traffic, suitable for hauling 12 or 15 cars.

Street Railway Engineers.—XV.

EDWARD B. IVES.

Major Edward B. Ives, chief engineer of the Electric Traction Company of Philadelphia, is a civil engineer of recognized ability and varied experience. He was educated at the Georgetown (D. C.) University, where he stood high in every department, and he also took the technical course at the School of Mines, Columbia College, New York. He then entered the United States Military Academy, at West Point, from which he graduated in 1878. Immediately upon graduating he was assigned to the 19th U. S. Infantry, and served in Colorado, Kansas, Indian Territory, Texas and New York Harbor, during which term of service he was actively engaged in extensive engineering operations, including the construction of Fort Hancock and the military survey of the western part of the State of Texas. He also served as instructor in drawing and topography at West Point. In 1889 he resigned, with the rank of First Lieutenant, and subsequently enlisted in the 1st Brigade Signal Corps, National Guard of New York, and is at present major and chief signal officer of the State of New York. After resigning from the army he rendered valuable service as assistant engineer in installing the coal-handling machinery and charging and discharging machines for the Manhattan Gas Company, at the foot of 18th Street, New York, and also did considerable electrical work for the Patton Multiplex Telegraph Company.

Prior to accepting his present position with the Electric Traction Company, Major Ives filled a similar one with the Broadway Railway, of Brooklyn, N. Y., which he vacated much to the regret of the officials of the road. His taste for engineering is natural, his father, Joseph C. Ives, who was graduated from West Point in 1858, having been a prominent and enthusiastic member of the U. S. Engineering Corps. Major Ives is a member of the American Society of Civil Engineers and of the American Institute of Electrical Engineers.



EDWARD B. IVES.

Protest Against Street Railway Mail Service.

In the Electric Railway Gazette of July 13 a curious letter from the car drivers of New Orleans, addressed to the postmaster-general, was reproduced. They protested against the introduction of the street railway mail service in the city, on the ground that they might be hampered if they should determine to strike. General Neilson, the second assistant postmaster-general, has answered the letter and assures the drivers that they "need have no fear of the authority of the government being used for anything excepting the government necessities."

Trolley Parties in Brooklyn.

The initial trip of the new illuminated cars designed for trolley parties took place on the system of the Brooklyn Heights Railway last Wednesday evening. The cars are of the double truck type employed on the Fort Hamilton and Bensonhurst lines, and have seating accommodation for about fifty passengers. They were illuminated by several rows of colored incandescent lamps arranged along the roof and bonnet and the dashboard. In addition there was an immense headlight made up of electric lamps so arranged as to form an attractive design.

The party which had been invited to enjoy the first trip by President Rossiter met near the City Hall Square at 8 p. m. and proceeded thence to Ulmer Park by way of Court Street.

The trip marked the introduction into Brooklyn of the new excursion cars. It is the intention of the company to charter these specially fitted cars to private parties desiring to make evening excursions to popular resorts in the suburbs of Brooklyn.

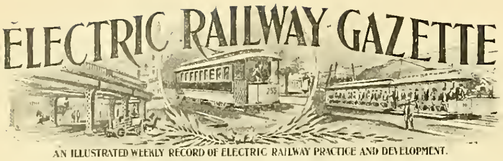
Two Electric Railways to Washington.

E. D. Smith & Co., of Philadelphia, have been awarded the contract for the construction of the Columbian & Maryland Electric Railway, which will connect Baltimore and Washington. The cost of construction will be $3,000,000, and according to the contract the work will be completed within a year. A contract for a second electric road between Washington and Baltimore, it is expected, will be signed at once. The enterprise is backed by the Washington, Sandy Spring & Baltimore Electric Railway. Allston Gerry and Nathan G. Miller, of New York, and James B. Colegrove and George S. Chase, of Washington, it is announced will take $750,000 of bonds. The Sandy Springs route will develop a section not now reached by railways. The Columbian & Maryland line, on the other hand, has been surveyed with a view of running express trains between the two cities over the shortest possible route, in competition with the Pennsylvania and Baltimore & Ohio railways.

Brussels Electric Railway.

The Brussels Electric Railway, according to the London *Electrician*, is an excellent example of international practice. The boilers are English, the engines German, the motors American, the contractors' chief engineer Italian, and, doubtless, some of the polite gentlemen in the general office are French.

ELECTRIC RAILWAY GAZETTE



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AS THE ONLY PUBLICATION in the world DEVOTED TO THE ELECTRIC RAILWAY INDUSTRY, and the only journal adequately treating THE NUMEROUS TECHNICAL FEATURES INVOLVED IN ITS MODERN DEVELOPMENT AND PRACTICE, the ELECTRIC RAILWAY GAZETTE aims worthily to represent the activity and progressiveness of the important interests to which it is devoted. Presenting ALL THE NEWS EVERY WEEK, and describing CURRENT IMPROVEMENTS AND DEVELOPMENTS immediately upon being brought forward, its pages offer to those engaged in the electric railway field the TIMELY ADVANTAGES ENJOYED IN OTHER ACTIVE AND IMPORTANT BRANCHES OF MODERN INDUSTRY, and to advertisers A LIVE AND ENERGETIC MEDIUM commensurate with their needs and one giving CLOSEST ACCESS TO THE COMMERCIAL OPPORTUNITIES OF AN EXTENSIVE AND GROWING BUSINESS.

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A SIGNIFICANT ALLIANCE.

The alliance between the Westinghouse Electric & Manufacturing Company and the Baldwin Locomotive Works, an outline of which is given in another column, is a combination of no small significance. The rapid development of electric traction naturally cannot stop at the mere conversion or displacement of horse car lines, or even the establishment of short suburban railways. The electrical equipment of two elevated roads in Chicago, the construction of the electric shifting locomotive for use at Baltimore and the adoption of electricity on the Nantasket Beach line are sure indications of steady progress in the direction of the general use of electricity as a motive power on urban, suburban and interurban lines, and the numerous connecting links and feeders for trunk roads, on which small and medium sized steam locomotives are now used. It would be an aspersion upon the intelligence of the clear-headed managers of the Baldwin Locomotive Works to suppose that this condition of affairs had not been fully recognized by them, even if the alliance with the Westinghouse Company did not furnish significant evidence in the matter. The combination is an exceedingly strong one in point of ability and experience as well as in capital and facilities, and there is no apparent reason why the arrangement should not result in substantial benefit to the vast industry of electric traction.

CONDUIT ELECTRIC RAILWAYS.

There has never been a time within the last few years when inventors were not active in designing and patenting new electric conduit railway systems, but the developments in practice in this department up to the present have been few in number. Just at the present time, however, a vast deal of interest is centring in the conduit railway. The Lenox Avenue road in New York City is now in successful operation. Within the last few days the operation of the conduit system of the Metropolitan Railway of Washington, D. C., has been started, and the management writes that it is "happy to state that everything is working very smoothly." In this issue we present an article descriptive of the system which the Third Avenue Company, of New York, has begun to install.

The plans on which the work is to be installed have been tested for so long a time in actual practice that there can be no question as to the success of the installation. Other conduit railway projects are under consideration in different cities, though none of them, perhaps, is of as great importance as the three enterprises mentioned. Hereafter it will be unnecessary to look to Buda Pesth to find an example of a successful conduit electric railway. It is interesting to note that two of the three conduit lines mentioned form parts of cable railway systems. Beyond a doubt the two companies are looking forward to the time when the distribution of power on the lines will no longer be effected by wire ropes, but by means of electricity. We have no doubt that the installations foreshadow the ultimate abandonment of the cable in New York just as certainly as the success of the overhead trolley system in Philadelphia meant the passing of the cable system in that city. Every cable company in the country is anxiously looking for some means by which it may lop off a cent or more from the cost of operation per car mile, and no plan gives promise of reduction in this respect except that which involves the installation of an electric system. It is now merely a question of time when the substitution of the conductor for the cable will be made in the conduits, and the time will probably be hastened materially by the results attending the operation of the three roads to which we have referred.

EUROPEAN EXCHANGE TICKET SYSTEM.

The exchange ticket system in use in many European cities presents several points of interest, and beyond a doubt it tends to protect the omnibus and tramway companies from imposition in their dealings with the public. The system, however, as explained by a writer in another column in this issue, is too complicated and cumbersome to meet with favor on this side of the Atlantic. The method of exchanging tickets must be a source of constant confusion and annoyance to strangers who, by their ignorance of the regulations governing the issue of the slips, must necessarily forfeit frequently the privileges of transfer which it is the purpose of the system to confer. Such a system would be found impossible of application on American roads, if for no other reason, because employees would refuse to perform the necessary detailed work which would be involved. The conductors on a Detroit railway, in fact, threatened to strike a few weeks ago merely because they were instructed to punch transfer tickets in the presence of the passenger, and the management found it advisable to abolish the obnoxious rule. We have found that the best results follow a system which is of the utmost liberality and simplicity. Our railways have discovered that the way to increase receipts is to stimulate travel by furnishing the best accommodations and extending the maximum transfer privileges. What our European friends would say to such a liberal system of transfers as is in use in Philadelphia, for example, it would be difficult to conjecture. They would doubtless consider a policy so liberal as suicidal, but the Philadelphia companies can show figures demonstrating that it has proved advantageous in the highest degree from a financial point of view.

The author of the article refers briefly to the system by which the carrying capacity of cars and omnibuses is restricted to a definite number or to those who can be accommodated with seats. A strong argument in favor of such a limitation can be urged when horses are used, but it has little force when cars are propelled by mechanical power. Not infrequently a newspaper on this side of the water starts an agitation for the application of "the no seat, no fare" policy, but were it put in practice, it would be utterly condemned by the public. During the busy hours, in every great city, companies find it to their interest to make every provision for the accommodation of the traffic. The traveling public is, however, thoroughly impatient of delay. When the average American wishes to reach any point he desires to take the first car which will carry him to his destination, no matter how crowded it may be, and he is unwilling to wait even two or three minutes, when, by so doing, he can ride in a car by himself. A change which would make the indulgence of this practice impossible would arouse almost universal condemnation. The policy pursued by European companies in the operation of their lines presents—as we have said—many points of interest, but it furnishes exceedingly few suggestions to companies operating under conditions existing in the United States.

The Westinghouse and Baldwin Locomotive Works Alliance.

Announcement was made on Monday last that arrangements had been completed for the formation of a partnership between the Baldwin Locomotive Works, owned by Burnham, Parry, Williams & Co., and the Westinghouse Electric & Manufacturing Company for the purpose of constructing electric locomotives and electric motive power equipment, and the development of an improved electric railway system.

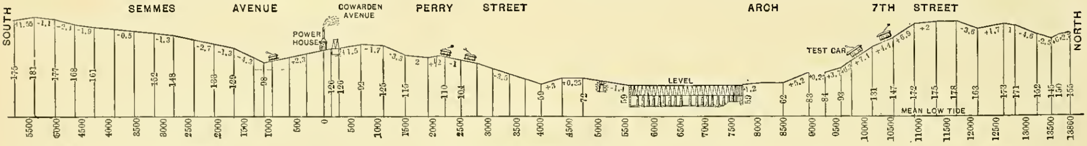
The exact terms of the combination have not been made public, but it is understood that each company will retain control of its own plant and establishment, and that, except in the construction of electric motive power equipment and the development of an improved electric railway system, their interests will be separate, that is to say, the Westinghouse Company will not have any interest in the steam locomotives built at the Baldwin works, and the Baldwin works will not share in the generator, dynamo and engine building business of the Westinghouse Electric & Manufacturing Company.

There will be improvements, as the increase in business warrants the changes, but there will be no consolidation of the capital of the companies as has been reported. Neither will a new company be formed, as has been stated, and the same board of directors will continue to direct the course of the two corporations as heretofore. In other words, the industries will remain just as they are, with the exception of proposed improvements or alterations as the case may warrant. According to the agreement, the Baldwin Locomotive Works will manufacture the bodies of the engines, while the Westinghouse Company will manufacture the electrical machinery to supply the motive power.

A member of the firm of Burnham, Parry, Williams & Co. is reported as having said: "We have long been thinking that the Baldwin Locomotive Works should take a prominent position in the management of electrical engines, but we found the electrical field so well covered by patents that an outsider must work under great disadvantage. The negotiations between the two companies to overcome this difficulty have been going on for more than two months, and we are now ready to join and undertake any contracts for locomotives run by electrical power. David Leonard Barnes, a railway engineering expert of Chicago, has been selected as the joint superintendent of the companies to overlook the construction of these locomotives."

No immediate extension of the Baldwin plant is contemplated as a result of the deal. The combination will, however, it is said, result in the employment of a considerable number of men additional in both of the works. The Baldwin works have already experimented in the construction of electrical engines. One was built recently for Henry Villard, of the North American Company, and a number of small trucks have been built for elevated railway use.

The combination is a strong one; the Westinghouse works, as is well known, are conducted on a most practical and efficient manufacturing basis, and the Baldwin works stand in the front ranks, if not absolutely at the head, of the world's locomotive builders. The combined capital of the two is put at $20,000,000, that of the Baldwin works, which is not incorporated, being estimated at $10,000,000.



PROFILE OF THE RICHMOND & SOUTH SIDE ELECTRIC RAILWAY SHOWING LOCATION OF CARS WITH TEST CAR NO. 5 ON MAXIMUM GRADE.

The Baldwin Locomotive Works were founded by Mathias W. Baldwin in 1831, and on April 25 of that year the first miniature locomotive was built, which made its initial trip on the Germantown road. The plant has been enlarged from year to year, until the buildings cover nearly 14 acres of ground and the plant has a capacity of turning out one locomotive every eight hours. Upward of 4,900 men are employed in the works.

Electric Locomotive.

To the Editor of Electric Railway Gazette:

Sir:—In reading the statements concerning the Heilmann steam-electric locomotive in your issue of Aug. 3, 1895, the idea naturally occurs, why not use for such purpose a high-speed impulse steam turbine directly driving a high-speed electric generator, which generator has, of course, suitably large armature conductors for the current needed, the necessary voltage being obtained in virtue of the enormous speed at which it runs? Such a generator feeding standard railway motors connected to the axles should afford an arrangement having all the advantages of the Heilmann construction while it would avoid its excessive weight. The electric apparatus might in such use be regarded merely as an ideal form of speed-reducing gearing between the impulse steam turbine and the driving wheels of the train. Otto Eames.

Lynn, Mass., Aug. 6, 1895.

Test of an Electric Railway. *

BY A. LANGSTAFF JOHNSON.

In the early days of electric railways the data for determining the average amount of current to allow per car could not be had, simply because a road had not been in operation long enough for engineers to make observations on this point.

In 1890 I constructed a line, which, for alignment, grades and local conditions, can be classed as a "difficult route"; curves 30 feet radius on grades in narrow streets, grades 7.4 per cent., and running over other roads. The road was operated by one Edison 80-kw generator, driven by a 100-hp Ball engine, and the equipment consisted of five cars mounted with two 15-hp Sprague motors each; these conditions made it highly favorable for giving results of practical value. I made a series of tests, not only to determine this point, but the total amount of current leaving the power house, when the cars were in the most unfavorable combination, *i. e.*, the majority ascending the grades. Although not as extensive and as accurate as I wished, yet I have considered them of sufficient interest to present to you. To accomplish this, on one of the cars was placed a Weston portable ammeter and voltmeter, on the other four cars were placed observers with time cards upon which they noted the time of passing previously marked points on the line, all watches being set with the clock at the power house, where an observer took the reading of the station instruments.

The accompanying profile and table give the general data of one of the tests, and one when the test car was going over the road from the south to the north. The profile shows the location of the other four cars at the very instant the test car was on the centre of the maximum grade ($7\frac{4}{10}$ per cent.), and the table gives the data taken on the car and in the power house during the test.

A study of the table brings out some very interesting points—(1) The maximum amount of current (100 amperes) was at 6:05 p. m., when the test car was on a level and 6,500 feet from the power house, and using the minimum amount of current (10 amperes). This was caused by the position of the other four cars, the time cards of the observers showing them either on the heavy grades or on the curves. (2) At 5:53 p. m. the test car used the maximum amount of current, and was also on a level and only 300 feet from the power house; as should be expected, there was no drop in the voltage. It is also seen that the test car, in passing around the curves at Seventh and Perry streets, Ninth and Arch streets and Seventh and Arch streets, took the same amount of current, but with a very large drop in the voltage (80 volts) at Seventh and

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*A paper read before the Electrical Section of the Franklin Institute, Philadelphia, Pa.

Arch streets. At first it was hard to explain this, but by a study of local conditions at this point, I discovered that the motorman had to shut off the current, and did not turn it on until he was in the centre of the curve, when he had to open it up to the seventh notch of the controller to force the car around this 40 feet radius curve, which readily accounts for the large drop that is shown. The same explanation applies to the curve at the Semmes Avenue Bridge; there the car had to cross a narrow bridge at low speed, on a curve of 35 feet radius. (3) On the maximum grade of 7$\frac{4}{10}$ per cent., which was 9,800 feet from the power house, it took 40 amperes and 440 volts (which was 40 volts drop on the line, or 23½ electrical horse-power, to take the test car up the grade at the rate of four miles an hour. The profile shows the test car on this grade, and the location and the direction of travel of the other four cars at this very instant.

These tests show very conclusively the electrical economy that can be gained by a continuous-running motor, which a great many attempts have been made to put in practical operation, but so far without success, and is a line on which inventors can work and experiment in the hope of a large reward, if successful; for it is evident, with a continuous revolving armature there would be only a small drop in the counter E. M. F., whereas, now, every time the motor is started it has to build up, and particularly in cities where the regulations require the cars to come to a full stop at each street crossing, the distances between stops are so short that the armature is revolving at a velocity to be of very little effect for only a few seconds, and really amounts to nothing.

From the profile and table the members of the Section can readily see many other interesting points, but the most important one shown by this test is the necessity of the electrical engineer to study the local conditions in proportioning the feed system of an electric railway, making use of the data given him of former work by his volt, and ampere-meters.

NORTH TRIP.

Time taken on Test Ca... P.M.	LOCATION OF CAR ON LINE.	Weight of Car and Passengers, Pounds estimated.	Rate of Grade per cent.	Length of Grade.	Distance of Test Car from Power House at time Readings were taken—(Feet).	Kind of Rail passed over.	Reading of Meters on Car.		Reading of Meters at Power House.		Horse-power delivered at Power House.	Horse-power developed by Motors in Moving Car.	Drop in Voltage on Line.	Radius of inside Rail of Curve.	REMARKS.
							Ampères.	Volts.	Ampères.	Volts.					
5·45	Thirty-fourth and Semmes Ave.	8,000	+ 1·5	310	5,500	T	20	460	60	480	38·6	12·3	20	—	Grades opposed to car going north, marked thus +
5·50	Semmes Ave. bet. power house and 22d St.	8,000	+ 2·3	1,000	1,000	T	20	460	80	480	51·5	12·3	20	—	
5·53	Curves at Semmes Ave. bridge	8,000	—	—	300	T	45	480	—	480	—	28·9	00	35′	
5·54	Curve at Cowardin and Perry	8,000	—	—	1,100	T	30	460	—	480	—	18·5	20	49′	Grades opposed to car going south, marked thus —
5·55	Fifteenth and Perry, Pass No. 2	8,200	—	—	1,500	T	—	—	80	480	51·5	—	—	—	
6.	Curve at Perry and Seventh	8,200	—	—	4,000	T	40	460	20	480	12·9	24·6	20	39′	
6.01	On Seventh bet. Perry and McDonough	8,200	+ 3·	360	4,200	Tram.	30	480	—	—	—	19·3	00	—	Grades are given in feet per 100 (per cent. %).
6 03	South end free bridge, Pass No. 3	8,200	—	—	5,600	Tram.	—	—	—	—	—	—	—	—	
6.05	On free bridge	—	0·0	—	6,500	Tram.	10	445	100	480	64·3	5·9	35	—	
6.06	Curve at Ninth and Arch	—	—	—	7,700	Tram.	40	460	—	—	—	24 6	20	39′	Each car equipped with two 15 h. p. motors (Sprague).
—	Curve at Seventh and Arch	—	—	—	8,500	Tram.	40	400	—	—	—	21·4	80	40′	
—	Seventh between Arch and Byrd	—	+ 5·2	300	8,700	Small grove.	20	440	—	—	—	11·7	40	—	
6.10	Seventh between Main and Cary	—	+ 7·4	300	9,800	Small grove.	40	440	90	480	57·9	23 5	40	—	Maximum grade.
—	Seventh between Franklin and Main	—	+ 2·0	300	10,400	Small grove.	15	444	—	—	—	8·9	36	—	
—	Seventh between Franklin and Grace	8,000	+ 6·9	300	10,800	Tram R.U.P.	25	400	—	—	—	13·4	80	—	Richmond Union Pass Track.
6.15	Seventh and Marshall	8,000	—	—	11,700	Tram R.U.P.	—	440	80	480	51·5	—	40	—	
—	Seventh between Clay and Leigh	8,000	+ 1·7	400	12,400	Tram.	20	420	—	—	—	11·2	60	—	

TEST MADE ON THE RICHMOND & SOUTH SIDE ELECTRIC RAILWAY.

The Employment of Two or Several Motors on Cars or Locomotives with Respect to Skidding.

BY PAUL HOHO.

Two or even more motors are frequently used on electric street cars and locomotives, and while certain practical conditions favor this disposition, it yet presents serious inconveniences.

Independently of the question of efficiency, which is diminished in a very great proportion, other conditions in certain cases militate against the simultaneous employment of two or several motors on the same car or on the same locomotive, or even on the same train. We will examine in this article the question more particularly from the point of view of the slipping or skidding of the wheels which can result from the combined action of the motors; the conclusions which follow are unfavorable to this disposition in cases more numerous than would appear at first sight.

In all these dispositions each motor actuates either one axle or a pair of axles. In order to fix ideas, let us take the case of a car resting on three or four axles, of which two are motor axles, each having a motor. Each motor will experience, when the motor car or locomotive is in motion, a rolling resistance which we will designate respectively by R_1 and R_2 for the first and the second motor; R_1 and R_2 thus designating the total rolling resistance offered to the motors, these resistances being considered as applied to the circumferences of the armatures of the two motors. Similarly Q_1 and Q_2 will designate the total resistance to slipping offered to the two motors, also considered at the circumferences of the armatures of the first and second motor. These resistances are those which each motor has to overcome before the transmitting parts can slip, or, more particularly, before the wheels will skid. The resistances, R_1 and R_2 on the one hand, as well as the resistances, Q_1 and Q_2, on the other, may be equal, but this is not always the case. Often there are even very great differences, as these resistances are very variable in relation to each other. Not only are they variable according to the load on the motor axles, but this load itself varies according to the position the car momentarily occupies on the road, according as it is on a level, on a convex or on a concave portion of the profile of the line.

In order to estimate their importance, it is sufficient to consider for an instant, and determine the variations of, the load on the axles of a car or locomotive for three cases: First, when the portion of the road on which the locomotive momentarily finds itself is level; second, when concave, and third, when convex. The resistances also vary according to the state of the rails, the organs of transmission and according to the position which the carriage momentarily occupies on the truck. The absolute equality of the resistances Q_1 and Q_2 practically never exist, and the difference between these resistances is sometimes very great.

The two motors are coupled either, A, in series, or, B, in parallel, whatever may be the mode of excitation of the magnetic field.

A. The Two Motors Coupled in Series. The torque at the circumference of the motor armature is equal to $K\, i\, \mathcal{H}$, where K is a constant depending upon the motor, i, the intensity of the current, and $\mathcal{H}$, the intensity of the magnetic field. It is evident that the two motors and their gears ought to be identical for various reasons, both practical and theoretical. As the motors are in series, the intensity, i, of the current is the same for the two motors. As to the two factors, K and $\mathcal{H}$, they are also the same, the motors being presumed to be identical, and it follows, therefore, that the torque is necessarily equal.

If everything is perfect, the motors and transmissions being absolutely identical, the resistance to be overcome by each motor being the same, everything will go well; the current will have a normal value with a uniform speed (at least momentarily), when the intensity of the current corresponds to the following relations:

$$K\, i\, \mathcal{H} = R_1 = R_2.$$

But we have stated that the rolling resistances with respect to the two motors are variable for these, and almost always differ in a measure more or less great.

Let us suppose $R_1 < R_2$, the torque, $i\, K\, \mathcal{H}$ developed by each of the two motors will then be greater for the resistance R_1 than that encountered by the first motor, and smaller than the resistance R_2 experienced by the second motor. The first will tend to accelerate the speed, the second to diminish it. But this is impossible, the two motors being necessarily restrained, have in every moment the same speed.

What will happen under these conditions? The speed of the car, that is to say, of the two motors, will possibly change, but from the instant when the sum of the torques is equal to the sum of the resistances, the speed will become uniform. At that moment the resistance offered to the first motor will be necessarily equal to the torque exerted by it. Now, as these torques are equal for the two motors, it follows that the individual resistance offered to the two motors separately will be divided in a different manner, such that they will become equal to the torques exerted by these motors and, consequently, equal between them; this division follows as a consequence from the fact that the first motor tends to accelerate the speed, while the second tends to diminish it, and consequently, the first motor encounters a resistance supplementary to its normal resistance, while the second encounters a negative supplementary resistance which diminishes the normal resistance.

From what precedes it will be seen that the new resistance, in some respects abnormal, R_1^1 and R_2^1, opposed respectively to the first and second motors, becomes

$$R_1^1 = R_2^1 = \frac{R_1^1 + R_2^1}{2} = K\, \mathcal{H}\, i.$$

But if the rolling resistance R_1 were less than R_2, it follows from the same cause which has led to this inequality, that the slipping of the first motor, Q_1, is less than the resistance to slipping of the second motor, Q_2. The causes lie, in fact, in the division of pressures or loads, being less on the first axle than on the second, or in frictional resistances, less in amount in the case of the first than in the second, these different resistances depending not only upon the state of the rails (which can vary from one point to another when special care is not taken), but also upon the state of the transmission parts of the two motors. Now, these same causes diminish the slipping resistance, Q_1, opposed to the first motor relative to the slipping resistance, Q_2, opposed to the second motor.

Under these conditions it can happen that Q_1 may be less than R_1^1, that is to say,

$$< \frac{R_1^1 + R_2^1}{2} \text{ and } < K\, \mathcal{H}\, i'$$

In this case, the most feeble resistance, that is to say, Q_1, the resistance to slipping, is the one which will be overcome; there will be a slipping in the organs of transmission if the construction permits this; or the wheels will slip on the rails, that is to say, they will skid.

Here it will be convenient to observe well the action of an electric motor. In order to give motion to the car there is at this moment but a single torque, $K\, \mathcal{H}\, i$, that which acts on the second motor, and which is insufficient to overcome the resistance, $R_1^1 + R_2^1$, which is equal to $K\, \mathcal{H}\, i'$. On the other hand, the motor in turning overcomes only the resistance Q^1 which is less than R_1^1, but at this moment it still exerts the torque, $K\, \mathcal{H}\, i' = R_1^1$; that is to say, the torque is greater than resistance Q_1. It will then accelerate the slipping, the counter E. M. F. will increase, the intensity i' will diminish, until $K\, \mathcal{H}\, i'' = Q_1$.

The same torque will be exerted at every moment by the second motor; this motor encountering the total rolling resistances $R^1 + R^2$ greater than its effort, $K\, \mathcal{H}\, i''$, will stop after the energy due to the inertia of itself and that of the car, feebly aided by the torque, $K\, \mathcal{H}\, i''$, will have been exhausted. At this moment in the second motor at rest, the current will circulate as in an inert resistance, causing simply the torque, $K\, \mathcal{H}\, i''$, without producing any mechanical work whatever.

The first motor will absorb alone the complete E. M. F. $E - (R + 2r)i''$, turning with a speed so much greater, and expending its energy $[E - i''(R + 2r)]1i''$ in the parts where the slipping occurs or in skidding. In the above formula, E is the E. M. F. at the extreme binding posts of the second motor, r is the electrical resistance of the first motor, which is equal to that of the second motor, and R is the electrical resistance exterior to the two motors between the extreme binding posts.

(*To be continued.*)

Comments and Views of Contemporaries.

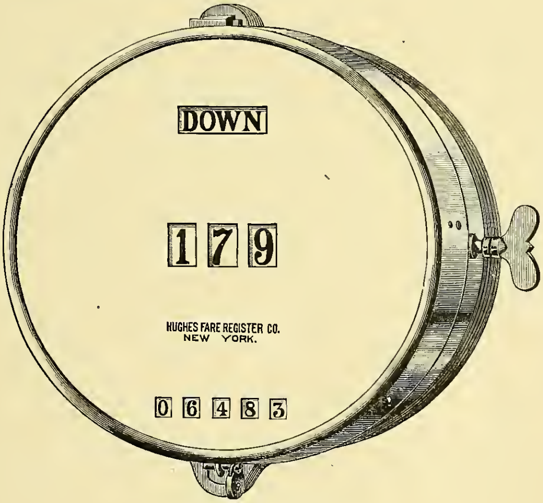
Electric Railways.—The experiment now going on on Nantasket Beach—and it is ceasing to be an experiment except in the way of judging the cost of motive power under different conditions—makes it clear that the street railway lines are not likely in the future to have a monopoly of electricity as a motive power. So far as cost is concerned, there is reason to think that the Nantasket railway service is operated at less expense under these new conditions than would be required under former methods of using steam locomotives; while the flexibility of the system by which one, two, three or four cars can be run, and these, if need be, quite independent of each other, together with the added advantage of an absence of cinders, makes it not strange that railway men and the users of railways should look upon this method as one which may be destined to revolutionize the suburban service of our steam railways. —*Boston Herald.*

The Westinghouse-Baldwin Combination.—This combination of the leading manufacturers of steam and electric motors cannot but have a far-reaching effect upon the whole system of railway transportation. It is evident already that the use of the "trolley" in short line passenger service must have lessened materially the demand for the lighter grades of locomotives and that for this service the development of the future is to be in the direction in which the Westinghouse concern has taken the lead. It is also clear, from many experiments already recorded, that the application of mechanical electricity to the steam locomotive, whereby the power derived from a given consumption of fuel may be enormously increased, opens new possibilities for the product of the Baldwin works.—*Philadelphia Times.*

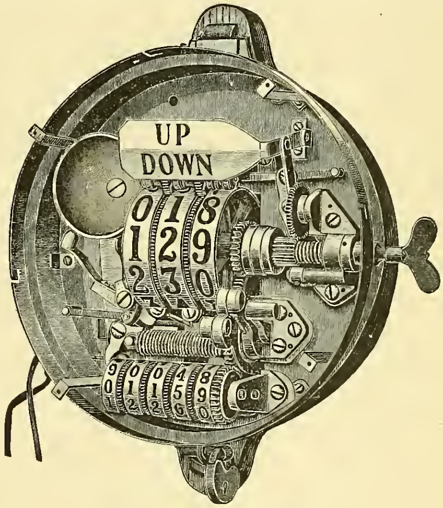
The Trolley in Evidence.—The deadly effect of the trolley on local railway traffic was again illustrated at the station yesterday, in the appearance of the Holyoke trains as they went out or came in. There were only a handful on some trains, and several that came in required a second glance to detect the presence of any passengers at all. Of those that did travel, the commuter and the drummer made up the bulk of the load. The result will be, necessarily, to reduce the number of trains, it is thought, as competition is wholly out of the question. A large slice was taken out of the River road's earnings when the Chicopee Falls and Chicopee lines were built; and now another large share of their traffic is diverted to the trolley line by the Holyoke extension. It is probable that the Northampton trade will suffer but little, eight or ten miles being all that the average man cares to ride at one sitting unless on pleasure bent.—*Springfield (Mass.) Republican.*

Hughes Fare Register.

The Hughes fare register which is illustrated in the accompanying cuts possesses several novelties in its construction. It is claimed that it embodies many features which combine to make it reliable and durable, while simplicity is retained. Special machinery, tools, and gauges have been constructed for each part, thus insuring a perfection in detail which is important in work of this character. As all the parts are interchangeable and numbered, it is only necessary in case of accident to order the part wanted, remove the broken piece, replace it with the new one, and the machine is ready for operation again, no filing or fitting being necessary. The register has a white enameled dial and a polished brass case and presents an attractive appearance.



HUGHES FARE REGISTER.



MECHANISM OF REGISTER.

The trip register records up to 999 fares, and the totalizer to 100,000. The fare numerals are large, and can be seen from any part of the car. No fare can be recorded without ringing the bell, and the bell cannot be rung unless the fare is also shown by the dial. The register is made by the Hughes Fare Register Company of New York City.

FINANCIAL NOTES.

A STREET RAILWAY LOAN IN LONDON.—The Toronto Railway Company, which operates by electric power the only street railway in Toronto, Can., has issued £323,000 of first mortgage 4½ per cent. sterling bonds. Of this amount £250,000 was issued in Canada and the remainder in London, where the subscription lists closed with £150,000 subscribers.

UNION TRACTION.—Persons who are supposed to be in close touch with President Welsh of the Union Traction Company, declare that the company will begin business with a paid-up capital of about $10,000,000. The understanding is that of this amount the People's Traction Company will turn over $1,200,000 bonds it has in its treasury, and the Electric Company will deposit its holdings of the Lehigh Avenue road, amounting to 10,001 shares, while the Philadelphia Traction Company will surrender the bulk of the stock of the Seventeenth and Nineteenth Street roads, Empire, Union, West Philadelphia Passenger Railway and others, having a market value of over $6,000,000—making the total value of securities to be placed in the treasury of the new company $7,700,000, which, added to the $3,000,000 to be derived from the first call on the stock, will make the aggregate capital $10,700,000. From this will be deducted about $3,000,000 for improvements now under way and in contemplation.

CHICAGO, ILL.—It is probable that the money due on the January coupons of the Lake Street Company's bonds held by William Ziegler will be called for within the next week or two. Ziegler recently presented the coupons for payment to the Farmers' Loan & Trust Company of New York, co-trustee with the American Savings Bank, of this city, but there were no funds on deposit there for that purpose. Formal application has not yet been made here, but in a communication received the other day inquiry was made as to the chances of getting the accrued interest from Jan. 1 to June 1, when the conditions imposed by the trustees were removed. The money placed on deposit covers only the face value of the coupons, and Ziegler was so informed. It is believed now that he will waive the matter of accrued interest, amounting to about $250, and send on his coupons for payment. Ziegler holds about $500,000 of the bonds, and there are less than $100,000 others on which the interest has not yet been paid.

THE METROPOLITAN OF KANSAS CITY.—The combined earnings expenses and fixed charges of railways now owned by the Metropolitan Street Railway Company, of Kansas City, for the year ending June 1, 1895, were as follows:

Gross earnings	$1,544,160
Operating expenses, including taxes and insurance	906,941
Net earnings	$637,219
Fixed charges, including interest on all mortgage bonds and on floating debt	365,920
Surplus earnings	$271,299

In addition to the lines of surface railways, the Metropolitan Street Railway Company has acquired practically all the stock of the Kansas City Elevated Railway Company, in consideration for which it has guaranteed $600,000 6 per cent. bonds and $2,000,000 4 per cent. bonds of that company. This guarantee is an obligation of the Metropolitan Street Railway Company, but is not a lien on the property. The results of the operation of the Elevated Railway Company are not included in the above statement.

NEW INCORPORATIONS.

THE SCENIC RAILWAY COMPANY, capital stock $15,000, has been incorporated at Cleveland, O., by J. B. Hanna, Geo. G. Mulhern, E. W. Radd and others.

THE MUNHALL STREET RAILWAY COMPANY, Pittsburg, Pa., has been formed to construct an electric railway by Albert H. Schultz and John W. Taylor, of Pittsburg, and S. L. Tone, of Rochester, Pa. Capital stock $3,000.

THE WILKINSBURG & RANKIN STREET RAILWAY COMPANY Pittsburg, Pa., has been formed by Albert L. Schultz, S. L. Tone and John W. Taylor, for the purpose of building an electric street railway. Capital stock, $24,000.

THE NORTHERN ELECTRICAL MANUFACTURING COMPANY, Madison, Wis., capital stock $50,000, has been incorporated for the purpose of manufacturing motors, dynamos, generators, etc., by D. C. Jackson, C. M. Couradson, A. O. Fox, W. F. Vilas, Madison, Wis.

THE YANKTOWN GENERAL ELECTRIC COMPANY, Yanktown, S. D., has been formed for the purpose of establishing and operating general electric light plants, by A. T. Nation, Bedford, England; Harry Eller, H. G. B. Swinhoe, Yankton, S. D. Capital stock, $50,000.

THE LAHARPE (ILL.) ELECTRIC LIGHT & POWER COMPANY has been incorported by Joseph R. Crabill, George Coulson and W. O. Butler to purchase, erect, maintain and operate an electric light and power plant in LaHarpe and vicinity. Capital stock $15,000.

THE DUNMORE STREET (PA.) ELECTRIC RAILWAY COMPANY, capital stock $75,000, has been incorporated to construct and operate an electric street railway in Dunmore. The promoters are P. J. Horan and T. E. Boland, of Dunmore, and I. H. Burns, of Scranton, Pa.

THE ELECTRIC LIGHT, POWER & TELEPHONE COMPANY, Eagle River, Wis., has been formed for the purpose of establishing an electric light, power and telephone system. The promoters are W. S. Carr, Byron Ripley and O. H. Campbell, Iron River, Wis. Capital stock, $20,000.

THE LITTLE FALLS & RICHFIELD SPRINGS RAILWAY COMPANY, Little Falls, N. Y., capital stock $20,000, has been incorporated to build and operate an electric street railway in Herkimer County, 18 miles long. The promoters are C. L. Tylee, F. H. Vielle, G. E. Tylee, all of Corning, N. Y.

THE SYCAMORE LIGHT & POWER COMPANY, Sycamore, has been incorporated by Frank C. Patten, Carrie C. Patten and Thomas L. Halloran, for the purpose of producing and disposing of light, heat and power for public and private use, and for manufacturing all appliances for such purposes. Capital stock, $30,000.

THE LA PORTE CITY ELECTRIC LIGHT & WATER COMPANY, La Porte City, Iowa, has been formed to build, maintain and control systems of electric light and water works, by W. D. Wagoner, E. Duke Naven, A. Van Valkenburg, J. C. Graham, and A. L. Walker, La Porte City, Iowa. Capital stock $15,000.

THE KANSAS & MISSOURI ELECTRIC RAILWAY COMPANY, Pittsburg, Kan., capital stock $25,000, has been formed to operate an electric railway in Crawford County, by Samuel Barrett, Pittsburg, Kan.; Robert Simons, West Chester, Pa.; Robert Rayben, Pittsburg, Kan., and C. J. Simons, Chetopa, Kan.

THE HOMESTEAD & CALHOUN PARK ELECTRIC RAILWAY COMPANY, Homestead, Pa., capital stock $18,000, has been incorporated for the purpose of constructing and operating an electric railway, by Nathan H. West, Thomas L. Brierly, George Gladden, James B. Neel, Robert M. Elliott, John F. Milliken. Reid Kennedy and Joseph A. West.

THE JENKINTOWN & FOX CHASE ELECTRIC RAILWAY COMPANY, Jenkintown, Pa., capital stock $20,000, has been formed for the purpose of constructing and operating an electric road. The promotors are Howard Fleck, Samuel L. Schively, James Satterthwaite, Thomas B. Harper, Howard Noble, Jenkintown; William P. Longstreth, Fox Chase, Philadelphia.

THE ELECTRIC TRANSPORTATION COMPANY, capital stock $25,000, has been incorporated at Jersey City, N. J., for the purpose of manufacturing and dealing in electric boats to engage in inland navigation. The promoters are Frank Ribbett, Rahway, N. J.; Samuel D. Collett, Brooklyn, N.Y.; Edward B. McCleas, George F. Evans and Charles E. Ainsworth, Jersey City, N. J.

PEORIA & FORT CLARK STREET RAILWAY COMPANY, Peoria, Ill., capital stock $150,000, has been formed to acquire, build, buy, own and operate street railways and plants for producing electricity, and to use, furnish and sell electricity for operating street railways, for light, heat and power purposes. The incorporators are William Barry, Emory D. Frazer and Charles S. Williston.

NEWS OF THE WEEK.

AUGUSTA, GA.—It is reported that the electric road is to be extended to the lake.

BROCKTON, MASS.—An electric railway is to be built between this place and North Easton.

AUGUSTA, GA.—It is reported that the Augusta Railway Company will extend its road to Lake Olmstead.

BIRMINGHAM, ALA.—The extension of the North Birmingham electric line into the suburbs is contemplated.

ST. AUGUSTINE, FLA.—The construction of an electric street railway is contemplated by the common council.

QUEBEC, CAN.—The Electric Street Railway broke ground this week preparatory to laying their rails in this city.

OLD ORCHARD, ME.—The construction of an electric road between this place and Kennebunkport is contemplated.

HILLSBORO, TEX.—Arrangements are being made for the construction of the Hillsboro Street Railway Company's line.

GARDINER, MASS.—The electric road is to be extended from the junction of Lake and Park streets to Crystal Lake Park.

FISHKILL, N. Y.—Surveys are being made for the building of an electric road to connect Wappinger's Falls and Fishkill.

WORCESTER, MASS.—The North End Street Railway Company has petitioned for an increase of capital stock to $35,000.

PALMYRA, N. Y.—The construction of an electric railway from the Central Hudson Railway to this village is contemplated.

LITTLE FALLS, N. Y.—Work will soon be commenced on the construction of a trolley line between this town and Richfield.

BRUNSWICK, MD.—The construction of an electric railway from this place to Middletown via Burkettsville is contemplated.

NEW BRUNSWICK, N. J.—The Brunswick Traction Company has applied for right of way through certain streets of the city.

GORHAM, ME.—The construction of an electric road is projected from Saccarapps to this place. Charles Libby is interested.

CAMDEN, N. J.—The Camden Horse Railway Company has applied for permission to construct a trolley line on the river road.

WOONSOCKET, R. I.—Work has been commenced by the Woonsocket Street Railway Company on the extension of its line.

MAYVILLE, N. Y.—An electric railway is projected from Chautauqua through this place to Barcelona Harbor on Lake Erie.

WEST GENESEE, N. Y.—Work has just been commenced on the construction of the new street railway through this place.

SCHOHARIE, N. Y.—An electric railway is to be built to this place in the near future. Ezra Twitchwell can furnish particulars.

PITTSBURG, PA.—A belt line is to be constructed by the Carnegie Steel Company to connect all its works in this city and vicinity.

TOTTENVILLE, S. I., N. Y.—The Amboy Division of the Staten Island Rapid Transit Railway is to be extended in the near future.

OCALA, FLA.—Bonds have been issued for the purpose of building the Ocala & Silver Springs electric road. J. K. Martin can give details.

SYRACUSE, N. Y.—The Syracuse & Oneida Lake Railway Company will build and operate an electric railway from yracuse to South Bay.

WASHINGTON, D. C.—It is announced that work will begin at once on the construction of the Washington & Baltimore Boulevard Electric Line.

BEATRICE, NEB.—The Beatrice Rapid Transit & Power Company has sold its franchise to Victor Lantry. The road will be extensively improved.

McKEESPORT, PA.—An application for a franchise has been made for the construction of a road from this city to Rostraver, a distance of nine miles.

STAFFORD SPRINGS, CONN.—Surveys have been completed for the construction of an electric road, and work will be commenced immediately.

HOMESTEAD, PA.—Work will be commenced at once on the construction of the Homestead & Highland Electric Railway from this place to Du Quesne.

YOUNGSTOWN, PA.—A franchise has been secured by the Youngstown Park & Falls Electric Railway Company to North Lima, a distance of 12 miles.

McKEESPORT, PA.—The Versailles Traction Company has decided to erect a large power house in McKeesport, for its line between this city and Boston, Pa.

PITTSBURG, PA.—Work has been commenced on the construction of the line from Twenty-third to Main Streets by the Fort Pitt Street Railway Company.

HILLSBORO, TEX.—The Hillsboro Street Railway Company is contemplating the construction of a trolley line at once. J. H. Graham, of Boston, is president.

CAMDEN, N. J.—The Camden, Gloucester & Woodbury Railway Company has been granted permission to extend its lines from Kaigns Avenue to Federal Street.

ELYRIA, O.—A franchise has been granted by the County Commissioners for the purpose of building an electric road from this city to Lorain, via Lake Avenue.

AUBURN, N. Y.—The Auburn City Railway Company has been granted permission to lay an additional track in Genesee Street between South and Owasco streets.

WASHINGTON, D. C.—Railway companies in this city have consolidated under the name of the Capitol Traction Company and will extend their lines in various directions.

WASHINGTON, PA.—A company is being organized for the purpose of building a line from this place to Woodside, Linden and Forest Glens. Benjamin F. Leighton is interested.

PITTSBURG, PA.—A new electric railway is projected to run from the south side. John O'Neill, at the Sixth Avenue Hotel, is interested and can be addressed for information.

BALTIMORE, MD.—It is reported that a road one mile in length is to be built to Chattoleane Springs, by the Pikesville, Reisterstown & Emory Grove Electric Railway Company.

SAUGERTIES, N. Y.—The construction of a trolley line here is contemplated. It will be a single track road, commencing at the Long Dock, and will run to the West Shore Railway depot.

BINGHAMTON, N. Y.—Work will be commenced this Fall on the construction of the Binghamton, Lestershire & Union Electric Railway, to be constructed between the points named.

PLAINFIELD, N. J.—A new trolley line is projected in Union County. It is to start from Trimbley and will connect at Cranford, with the trunk line of trolleys for Elizabeth and this place.

PORTLAND, ME.—It is reported that Yarmouth, Cape Elizabeth and Gorham are to be connected with this city by an electric railway. Charles K. Robinson is interested and can furnish particulars.

ST. CLOUD, N. J.—A company has been organized for the purpose of building a trolley line from the Highland Avenue station of the D., L. & W. over the Orange Mountains to this place.

RICHMOND HILL, ONT.—A petition is being signed urging the Town Council to grant a bonus of $10,000 toward the extension of the Metropolitan Electric Railway from Toronto to this town.

LONG ISLAND CITY, L. I., N. Y.—A syndicate has been organized known as the Long Island City Heights Association, to build a street railway up Thompson Avenue to Hunter's Point ferries.

BALTIMORE, MD.—A committee has been appointed to secure right of way for an electric line to Witheredsville and Franklintown in the suburbs. P. H. Judik, president of the People's Bank, is interested.

MT. AIRY, OHIO.—The citizens of Mt. Airy held a meeting recently, and appointed a committee to make an effort to have an electric line built from Cincinnati to Mt. Airy and on to Venice, 18 miles distant.

PATCHOGUE, L. I., N. Y.—A company is to be incorporated for the purpose of building the Patchogue & Port Jefferson trolley line. O. T. Fanning, of Riverhead, and J. T. Sweezie, of this place are interested.

PHILADELPHIA, PA.—The Philadelphia & West Chester Traction Company has authorized an increase of capital stock from $187,800 to $400,000 for the purpose of completing the road and putting it into operation.

SUSQUEHANNA, PA.—The Susquehanna Electric Light Company and other parties are figuring upon the cost of building an electric railway between Susquehanna and the Delaware & Hudson Station at Lanesboro.

TOWER CITY, PA.—A company has been organized for the construction and operation of a trolley road from this city to Lykens, for which right of way has been secured. Philip Portner, of Girardville, is interested.

PITTSBURG, KAN.—The Kansas & Missouri Electric Railway Company has been chartered for the purpose of constructing a railway line in Crawford County. Samuel Barrett and Robert Bobbin, of this place, are interested.

TACOMA, WASH.—The electrical equipment of the Tacoma Traction Company's line from Tacoma to Fern Hill and Puyallup has been completed, and the new motor cars have superseded the steam dummies operating on that portion of the line.

TRADE NOTES.

THE NEW BRITAIN MACHINE COMPANY, of New Britain, Conn., has acquired all patents and property of the Case Engine Company, as well as adjoining land for the increase of the business, and will continue the manufacture of the well-known Case engine.

THE C. W. HUNT COMPANY, 45 Broadway, New York, has sold the Taylor Iron & Steel Company, of High Bridge, N. J., a complete equipment of cars and track for handling its material, and the Otis Company, of Ware, Mass., has again added to its already very complete system of Hunt industrial railways.

THE CONSOLIDATED CAR FENDER COMPANY, of Providence, R. I., has just received an order from the Union Depot Street Railway Company, of St. Louis, to equip its entire system, and Col. A. C. Woodworth, manager, reports business generally as good. The Consolidated fender possesses a good record for effective work.

DISSOLUTION OF PARTNERSHIP.—The firm of Noll & Sibley, manufacturers' agents, has been dissolved, Mr. Noll withdrawing in order to accept an exceedingly flattering offer in another line of business. Mr. Sibley will continue to represent prominent manufacturers of electrical supplies, with headquarters at the same address—Postal Telegraph Building. The style of the new firm is C. C. Sibley & Co.

MR. MAX A. BERG, for many years connected with the electric railway department of the Ansonia Electric Company, and afterward secretary of the Wallace Electric Company, Chicago, is now connected with the Ohio Brass Company as its Chicago agent, with offices at 1318 Monadnock Block. Mr. Berg's record in business life is one that any young man could justly be proud of and the Ohio Brass Company is to be congratulated upon securing his services.

THE SWARTS METAL REFINING COMPANY, 120 West Lake Street, Chicago, has issued a substantially bound catalogue descriptive of the various anti-friction metals made by it, which will be found of interest to station managers. One of the departments of this enterprising firm is devoted to the handling of scrap metals, which business has assumed vast proportions, particularly in Chicago. It is estimated that the scrap metal business in that city alone amounts to not less than $3,000,000 per annum. Nearly the entire amount of scrap accumulated throughout the Western and Southern states is marketed there.

A SMOKELESS COAL.—Superintendent of Motive Power William Garstang, of the Big Four Railway, and William S. Morris, Superintendent of Motive Power for the Chesapeake & Ohio Railway, are very enthusiastic over the success on their respective lines in the use of New River smokeless coal. It has been given a thorough test on the passenger engines of both lines, and in addition to abating the smoke nuisance has been found to be very economical. The city of Chicago used over one hundred thousand tons of this coal last year. The coal is mined on the line of the Chesapeake & Ohio Railway along New River, and transported via that line in connection with the Big Four.

THE CREFELD ELECTRICAL WORKS have secured the entire plant of the late Campbell Electrical Supply Company, at Watertown, Mass., and are removing the same to its factory at Saylesville, R. I. As the purchase of this plant included machinery, stock and good will, the Crefeld Company will continue the manufacture and sale of the widely known "Century" line wires and weatherproof tape, the services of the former superintendent of the Campbell Company having been retained. While it is pretty well known, it is at the same time worth repeating, that Bibber, White & Co., selling agents of the Crefeld wire products, are obtaining a strong foothold with the electrical trade.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has appointed Mr. Calvert Townley its New England agent, to succeed Mr. E. N. Sanderson, who goes to the Pittsburg office in order to be in close association with Mr. Zimmerman, of the executive management of the company. Mr. Sanderson, while in New England, did a good business for the company, and made many friends who will regret his departure. Mr. Townley is in every respect a worthy successor. He has been connected with the company almost from its organization, and has always been closely identified with Vice-President Bannister, whose headquarters are now in New York, and with whom he will be in nearer touch in Boston than if located in Pittsburg.

THE TOLEDO TRACTION COMPANY, Toledo, O., has let the following contracts for its new station equipment: Four engines aggregating 4,000 hp to the American Wheelock Engine Company, Chicago; two 500-hp boilers to the Heine Safety Boiler Company, St. Louis; two 1,000-hp economizers to the Fuel Economizer Company, of Matteawan, N. Y.; six furnaces to the Hawley Down-Draft Furnace Company, of Chicago, Ill.; four 800-hp rope drives (of the Hoadley system) to the American Wheelock Engine Company; one 20-ton traveling crane to the Brown Hoisting Company, of Cleveland, O.; three 500-kw direct-coupled railway generators to the General Electric Company. The machinery contracts yet to be let are for shaftings and pulleys, four air pumps, piping system and coal and ash conveying machinery. Sargent & Lundy, Chicago, are the consulting engineers.

H. E. COLLINS & CO., sole agents for the Cahall vertical water-tube boilers, manufactured by the Aultman & Taylor Machinery Company, of Mansfield, O., reports the following among other recent sales of Cahall boilers: Cornwall Iron Company, Cornwall, Pa., 500 hp.; Wellsville Plate & Sheet Iron Company, Wellsville, O., 500 hp; Apollo Iron & Steel Company, Pittsburg (third order), 7,000 hp; Union Iron & Steel Company, Youngstown, O., 300 hp; Andrews & Hitchcock Iron Company, Youngstown, O., 250 hp; Union Rolling Mill Company, Cleveland, O., 150 hp; Logan Iron & Steel Company, Lewistown, Pa., 150 hp; Siemens & Halske Electric Company, Chicago, 250 hp. Messrs. Collins & Co. report that they have been under great pressure to fill orders received, but are now relieved by the addition to their plant now partially in operation, which, when finished, will be capable of turning out 1,000 hp per day.

THE BASS FOUNDRY & MACHINERY WORKS, of Fort Wayne, Ind., reports through its Eastern manager, Mr. F. Ruel Baldwin, that the works are running 24 hours a day. Besides a number of standard engines the company has recently installed two 19-36x48-inch cross-compound engines at the plant of the New Jersey Electric Railway Company at Hoboken, N. J., rated at 500 hp each, and the Ocean Grove Association, Ocean Grove, N. J., has just started a 30x48 improved Bass engine, which, when the plant is completed, will be compounded with a 20x42-inch Corliss engine now in the old station; the boilers, three 72x18 return tubular, with butt joints, double covering strips and triple riveted for carrying high pressure, were also furnished by the Bass Company, together with piping, etc., complete. The Bristol & Plainville Tramway Company has added to the present lighting plant, installing a 16x36 and a 16-30x42 cross-compound engine; the former is in place ready to run, and the compound is nearly ready for shipment. A 150-hp Bass engine and boiler, designed for high pressure, are being installed by the New England Engineering Company, of Waterbury, Conn., in an electric lighting plant at Branford, Conn.

THE MICHIGAN ELECTRIC COMPANY, of Detroit, has recently completed an arrangement with the Edison Illuminating Company, of Detroit, and the General Electric Company, covering the selling agency of the General Electric machinery and supplies in Michigan, and, consequently, the General Electric Company will at once close the office it has maintained in Detroit. This arrangement covers the entire line of General Electric product, including lighting generators, motors, incandescent lamps, and all the various lines of machinery and supplies manufactured by the Company, excepting the matter of overhead railway material, in which line the Michigan Company will continue to manufacture and sell the "Michigan" hangers, etc., which have obtained a most satisfactory recognition among the street railway companies. The company has recently engaged Mr. H. E. Baldwin, formerly representing the General Electric Company in Kansas, Missouri, and Oklahoma, who will look after the Illinois State trade, and Mr. L. J. Baldwin will hereafter be in charge of the sales at the company's headquarters. The Michigan Company, which was incorporated about two and a half years ago, has grown rapidly during that period, and to-day has one of the largest and best equipped supply houses in the country. The arrangement with the General Electric Company is one on which both parties are to be congratulated.

Record of Electric Railway Patents.

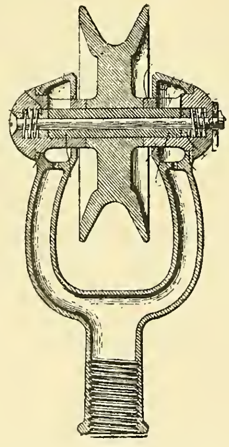
UNITED STATES PATENTS ISSUED AUGUST 5, 1895.

543,522. BRAKE FOR RAILWAY CARS; Rowan T. F. Dodds, Louisville, Ky. Filed Sept. 10, 1894. In a brake, the combination of a friction wheel designed to be fixed to a car axle, a depending hanger having an arched portion located over the wheel, and vertical sides connected with the terminals of the arched portion; segmental brake-shoes pivotally connected with the sides of the hanger and arranged at the bottom of the wheel; a spring for holding the brake-shoes normally off the wheel and connected with their adjacent ends; a lever fulcrumed on one of the brake-shoes and provided with a circular head, and the upper and lower chains arranged on opposite sides of the circular head and connected with the other brake shoes.

543,529. ELECTRIC TROLLEY; George W. Hooper, Rochester, N. Y. Filed Sept. 11, 1894. A trolley comprising a yoke having transverse openings in its ends, a wheel having a rigid hollow shaft, hollow bushings having heads or flanges at their outer ends engaging the yoke and inwardly extending portions receiving and forming bearings for the ends of said rigid hollow shaft, and a clamping bolt passing freely through said hollow shaft and uniting said bushings and holding the yoke against spreading. (See Illustration.)

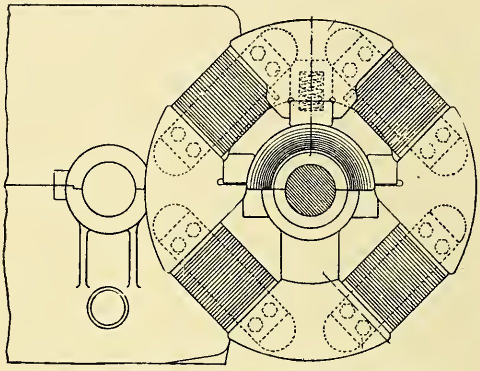
543,544. ELECTRIC CAR BRAKE; George B. Damon, Lowell, Mass., assignor of one half to Gardner W. Pearson, same place. Filed April 9, 1894. In a system of brakes for electric cars, a double controlling stand, consisting of an outer stationary cylinder, a movable cylinder revolving inside the stationary cylinder, a handle attached to the axis of the movable cylinder, both cylinders carrying on their upper adjacent surfaces contacts which engage when the movable cylinder is turned in one direction from a given point closing the circuit between the source of electricity and the car propelling motors, and on their lower adjacent surfaces contacts which engage when the movable cylinder is turned in the other direction from the given point closing a shunt circuit passing through the brake motors, both circuits being open when the movable cylinder is in the position first indicated.

543,605. RAILWAY SWITCH; Axel A. Strom, Austin, assignor to the Strom Manufacturing Company, Chicago, Ill. Filed June 8, 1895. In combination with a split switch, the point-rail connecting-bar provided near its opposite ends with clips, and adjustment plates secured to the point-rails to extend at their inner sides and each provided with an adjustment line inclined to the line of the main rails and adapted to be connected with a clip on the adjacent end of said bar.



NO. 543,529.—ELECTRIC TROLLEY.

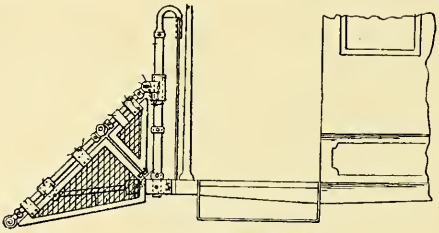
543,653. ELECTRIC BRAKE-SHOE; William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed March 30, 1895. An electric brake-shoe consisting of a magnet arranged about a car axle, and suspended at a single point above the car axle, said shoe being adapted to slide on its point of suspension, and a spring connection at the point of suspension by means of which the shoe is moved back to and retained in its normal position, and is relieved of friction. (See Illustration.)



NO. 543,653.—ELECTRIC BRAKE-SHOE.

543,687. CAR FENDER; Thomas Houghton, Philadelphia, Pa. Filed May 11, 1895. In a fender, shoes having a connecting rod, a rotatable spool having a rod with a disc thereon provided with a toothed portion, a pivoted lever having a pawl engaging said toothed portion, means connected with said lever for releasing said pawl from said toothed portion, a rheotome, and mechanism connecting said rheotome and disc for operating the former on the movement of the latter.

543,705. RAILWAY SWITCH; Isaac N. Saddler, Perrysburg, Ohio. Filed April 22, 1895. In a railway switch, a contact piece or shoe, adapted to be engaged and actuated by a passing car, means for holding said contact piece normally in operative position, detents on said contact piece, means for holding said detents normally in inoperative position, bell crank levers adapted to be engaged by said detents, a switch point or rail, and suitable connections intermediate said switch point or rail and said bell crank levers, in combination with a normally open electric circuit, electromagnets in said circuit adapted to throw said detents into engagement with said bell crank levers, means on said car for opening and closing said circuit, and an electric switch in said circuit whereby said electromagnets are energized alternately.



NO. 543,775.—CAR FENDER.

543,775. CAR FENDER; George H. Modemann, New York, N. Y. Filed July 2, 1894. In a fender for street railway cars or other vehicles, the combination, with a frame comprising vertical rods, having a fender body slidably mounted thereon, angle braces secured to the car in which said rods are removably inserted, and pins ranging across the said angle braces, of one or more supporting bars secured to the fender, the said bars having at the rear thereof a head provided with a curved lug adapted to rest upon one of the pins and engage beneath the other, whereby the said bars are pivoted to the frame and removable therefrom. (See Illustration.)

Electric Railway Gazette.

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Summer Resort Electric Railway.

The West Shore Railway, running out of New Haven, furnishes an interesting example of a Summer resort road. The route which the line follows is one which is especially picturesque, and the patronage of those who ride solely for pleasure during the warm weather is naturally attracted, but in the main the traffic is derived from those who visit the pleasant resorts near the city, and from the residents of the Summer hamlets lying along the road. The railway is operated during the entire year, but it is profitable only during the warm weather. Its owners are strong believers in induced traffic, and it will be seen from the appended brief description of the line that not a few attractions have been provided to stimulate the traffic. To those who may be contemplating the construction of roads of this kind the West Shore Railway will be found of great interest.

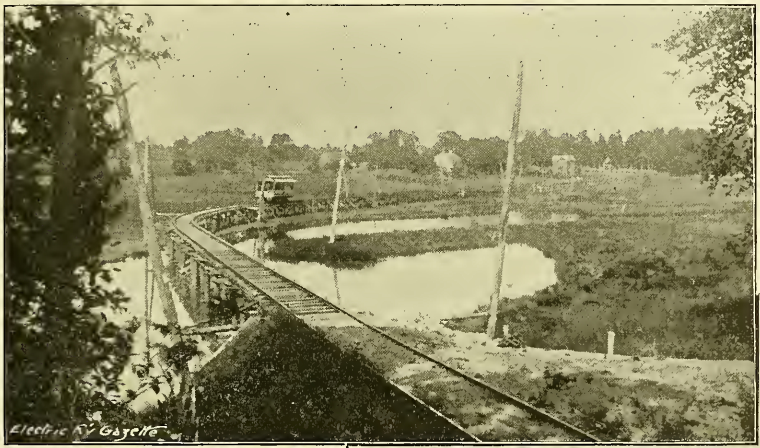


FIG. 1.—TRESTLE AT WAVERLY GROVE.

The line is only four miles long, extending from Savin Rock to Merwin's Beach, through a region naturally beautiful and made interesting by historical associations. The right of way, which is owned by the company, extends from the New Haven Green at Church and Chapel streets, although the road is in operation at the present time from Savin Rock only, where connection is made with the cars of the Winchester Avenue Railway Company. The line was opened in July, 1894, and has shown a steady increase in traffic since that time.

From Savin Rock the line runs close to the shore of Long Island Sound, passing through several attractive Summer resorts, the most notable of which perhaps is Woodmont, pleasantly situated on the shore at a short distance from the railway. Here are located cottages belonging to a number of prominent residents of Connecticut. The road extends thence through a picturesque region to Colonial Park, which is located between the railway and the shore. Here has been erected the Connecticut State Building which was originally built at the World's Fair in Chicago. The structure is finely situated on a knoll overlooking the Sound, and within a short distance of the Woodmont station of the railway.

The site of the building is one of the most interesting spots in the State, from a historical point of view. At a short distance away the British fleet lay at anchor off the shore on July 4 and 5, 1779, at the time of the invasion of New Haven. The park, beyond a doubt, will prove one of the main attractions of the railway. Those interested in the road were largely instrumental in purchasing the building and transfering it to its present site. It is thought probable that the structure will be used for a Summer school of philosophy and lectures will be given there during the Winter months. The building will probably be rededicated, and it is expected that the State Commission which had charge at Chicago will assist in perpetuating the structure.

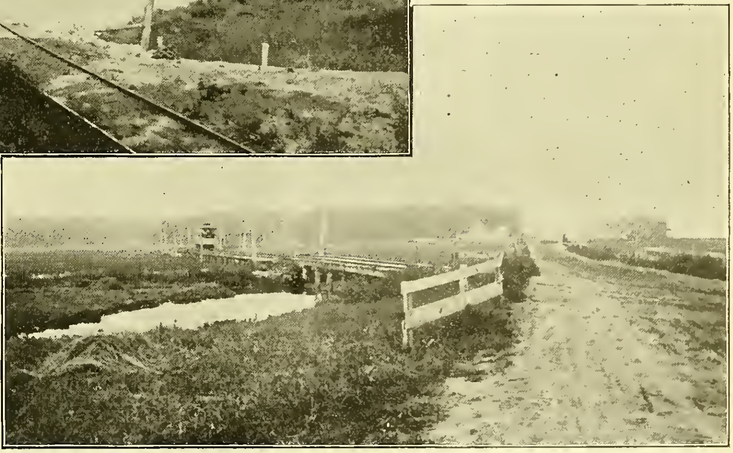


FIG. 2.—BRIDGE OVER OYSTER RIVER.

A view from the shore showing the front of the building is given in Fig. 3.

Another interesting point on the line is at Waverly Grove, where the road runs over the trestle bridge, shown in Fig. 1. The bridge is located close to the water, and a fine view of the shore and Sound may be obtained from the cars. Fig. 2 shows a view on the line of the road at the bridge over Oyster River.

The terminus of the road is at Merwin's Beach, shown in Fig. 4. This is a very attractive point, and a favorite day resort of many of the citizens of New Haven. The bathing beach is one of the finest along the shore.

The company at present does not own a power plant, and current for operating the road is supplied from the power station of the Winchester Avenue Railway Company, which operates the New Haven & West Haven Railway.

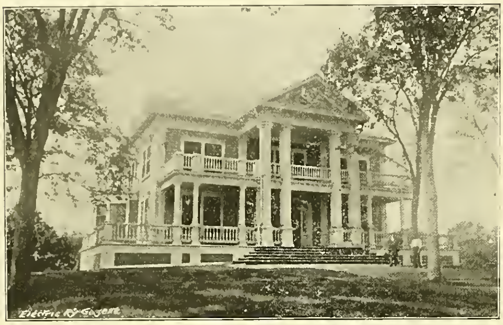


FIG. 3.—CONNECTICUT STATE BUILDING AT COLONIAL PARK STATION.

The roadbed throughout is of a substantial character. The tracks are laid with 60 lb. T-rail spiked to chestnut ties, 14 ties being laid to each rail length. There are no curves under 54-feet radius and the steepest grade is 4 per cent. The rails are bonded throughout with the Chicago rail bond. Wood side poles are employed and the overhead material was supplied by the New York Electrical Works.

The cars were supplied by the J. G. Brill Company, of Philadelphia. They are provided with 16 reversible cross-seats, and have accommodations for 32 passengers each. Each car is equipped with two 25-hp Westinghouse motors mounted on trucks of the Brill type.

The exteriors are handsomely decorated, and are ornamented with pictures of the Connecticut building. All of the platforms are provided with the Woods patent folding gates. The interiors are very tastefully finished. The seats are covered with plush, and the windows are of large size, with narrow sashes, and when opened practically make a Summer car. New Haven fare registers are employed on all of the cars.

That the road is popular with its patrons is indicated by the steadily increasing business. The officers of the company are J. D. Dewell, president; J. A. Kelsey, secretary and general manager; H. Sutton, treasurer.

Annulment of Charter Applied For.

The Second & Third Streets Passenger Railway Company, of Philadelphia, and its lessee, the Electric Traction Company, have petitioned the attorney general of the State for a writ of quo warranto against the Moyamensing & Penrose Ferry Road Passenger Railway Company compelling it to show by what authority it exercises the franchise of constructing, maintaining and operating a street railway, and why it should not be ousted therefrom. It is said that the action is regarded somewhat in the nature of a test case, as there are several street railway companies which have secured privileges from the city, and which, it is charged, are liable to forfeiture of charter on account of the same derelictions alleged in the petition. The Electric Traction Company claims that a charter was granted to the Moyamensing & Penrose Ferry Road Company, giving it rights on certain streets, the right to which had already been given to the Second & Third Streets Passenger Railway Company, and that an act of Assembly was thereby violated. It is also alleged that the Moyamensing & Penrose Ferry Road Company violated the act of Assembly under which it was incorporated and the ordinance of the city granting its privileges, and, therefore, has no rights and should be ousted.

Applications of Brooklyn Strikers to Be Given Preference

For some little time negotiations have been in progress to bring into friendly relations the Brooklyn Heights Railway and its former employees who left their places during the strike of last winter. The president of the company has met the representatives of the men several times, and an agreement by which the application of old employees for positions will be given preference has been reached. The agreement has been entered into formally and a copy of it is given herewith :

"Memorandum in the interest of the re-employment of the former employees who left the service of the Brooklyn Heights Railway Company in January last. All persons who left the service of the company through the strike and who are not employed by the company will be given preference for employment, providing the qualifications and merit of the applicant shall be satisfactory, and will be re-employed by the company just as rapidly as vacancies occur, and in so far as possible on the lines on which they formerly worked, and men now in the service will be allowed to transfer to the lines on which they formerly worked if they so desire, and it can be done without injury to the service. The company or any of its officials will not discriminate against any labor organization. In consideration of the foregoing District Assembly No. 75, K. of L., will use every endeavor to restore the company to public favor and recommend the lines of the company to the public for their patronage."

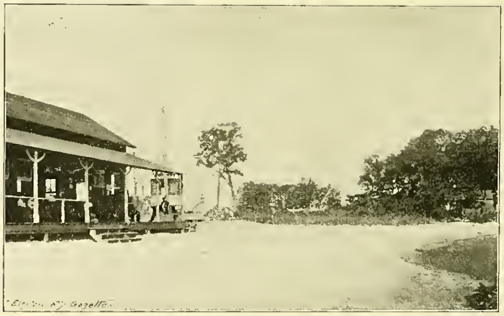


FIG. 4.—TERMINUS OF THE ROAD.

Practical Notes for Motormen.—XI.

BY GEORGE T. HANCHETT.

Series-Parallel Controller.

Probably no problem that the student of electric railway work has to encounter will prove more perplexing than the series-parallel controller. The student who has difficulty with this may console himself with the reflection that many an electrician who is really proficient in his business has run up against the same snag, even when he "thought that he understood it in a general way, but have not bothered to trace it out yet."

While apparently quite complex, the series-parallel controller resolves itself into quite a simple matter when considered piecemeal. It cannot be understood by any casual observation of diagrams. Although to every series-parallel controller there are usually twenty-one, or more, wires, that should be no cause for giving up the understanding of the controller as a work of too great difficulty.

No two companies agree in their methods of connecting up motors for series-parallel control. We may teach division by first explaining principles, and second by performing a problem or two. We must so proceed in explaining series-parallel control. The principles which must first be understood are as follows:

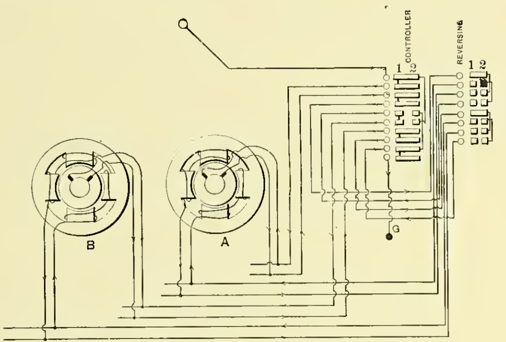


FIG. 42.

First.—There is but one source of current and one return. Hence the current which enters from the trolley wire must ultimately find its terminus at the ground screw, no matter how devious its path may have been or how many paths it has followed.

Second.—If we disregard lighting and heater circuits there are never more than two paths for the current from the trolley to the ground when two motors are used.

Third.—When two controllers are used the system is by no means the more complicated. Each motor requires four wires, and these eight wires branch, making 16 wires, one half of which go to one controller and the other half to the other. This will be more clearly shown by Fig. 42, from which it will be seen that the motor wires simply branch off from the wires from the controller. These eight wires are continued slightly beyond the branch, and may be connected to another controller in precisely the same manner as is the one shown.

The controller of Fig. 42 is simply an ideal one having but two speeds, namely, one half and full speed. It is, however, chosen on account of its simplicity, so that principles may be readily explained. Although there are eighteen wires going to the controller, when we consider that each motor requires four reversing wires, and that the trolley and ground wires take two more, that leaves us but eight contacts with which to make the necessary changes of connection to produce change of speed. Of these eight contacts it will subsequently be noted only two are absolutely necessary in the controller shown, as the others keep the same positions whether the controller be on notch 1 or notch 2.

It is hardly necessary to say that there are two important positions of the series-parallel controller when in action; one when the two motors are in series, and each absorbing one-half of the voltage. By the equation

$$S = \frac{E}{C\ f\ K}$$

it should be readily seen that this should produce one-half speed. The second important position of the controller is that which throws the two motors in multiple. Each motor then receives the full voltage, and consequently has full speed.

Most series-parallel controllers are simply cylinders on the surface of which are conducting plates. Against the surface of the cylinder rest contact fingers which press against these plates. The plates are suitably connected among themselves so that rotation of the cylinder under the fingers to any certain position will produce the desired connections. These different positions are called notches, and are usually indicated by an index on the top of the controller box. A wheel attached to the controller spindle and carrying on its periphery smooth depressions into which plays a pawl which is so shaped as to admit of ready motion in either direction, serves to hold the controller at its various notches, and also to allow the operator to locate these positions by feeling instead of by sight. In making controller diagrams it will be considered that a cylindrical controller is used. The "fingers" of the controller will be represented by small circles, while the plates of the controller cylinder will be shown on the developed surface thereof. By imagining that the developed surface be moved toward the contact fingers and stopped at any position over which there is a figure, the path or paths of the current at the notch corresponding to that figure should be readily traced. The reversing switch will always be considered as a similar but separate cylinder. It will be readily understood that the reversing cylinder can have but three notches, namely: forward motion, reverse motion and the "off" position. In order that we may take up the simplest case thoroughly, it may be well to trace out the connections of Fig. 42.

Let us suppose that the row of circles or contact fingers be on notch 1. The current enters from the trolley, and passes via the upper two contact plates to the armature of motor *A*. Although *A* is a series motor the current does not immediately pass through the field magnets upon leaving the motor. It must first return to the controller and find out by means of the reversing switch *in what direction* it must pass through the field magnets. It enters the controller, and via two more contact plates it passes to the reversing cylinder, which we will suppose is on notch 1. It leaves the reversing cylinder, passes through the field magnets, and returns to the controller at the fifth contact below the top. It is not yet permitted to return to the ground, but is obliged to pass through motor *B* in precisely the same manner as it did through motor *A*. It then finds its exit at the ground screw, *G*. When the controller is on notch 2, the difference is that when the current has worked down to the fifth contact via motor *A* it passes to the ground. Also motor *B* receives its current from the sixth contact from the top, directly from the trolley. Otherwise the conditions are exactly the same as in the case of notch 1.

It would seem unnecessary to return to the controller so many times with the wires, for it is only the two middle contacts on the controller cylinder that have any change in passing from notch 1 to notch 2. However, the transition from a controller of this type to one of the practical designs is much more easy than if the controller was simplified. Also manufacturers frequently resort to this device in order to subdivide the arcing at the fingers, much reducing it thereby.

(*To be continued.*)

Right of One Company to Use Tracks Belonging to Another.

Judge Tuley, of Chicago, has handed down a decision denying the application of the Chicago General Railway Company in its somewhat noted suit against the Chicago City Railway Company. The incidents which led to the litigation have already been narrated in these columns. The complainant, which operated a street railway on West Twenty-second Street, in Chicago, found itself unable to secure a down-town route for its cars. Efforts to conclude an arrangement with the Chicago City Railway Company were attended by no success. The company's officers then announced the somewhat startling principle that it possessed the right to send its cars over the tracks of another railway company, without regard to the latter's wishes in the premises, just as the owners of teams had the privilege of driving over these tracks. When an attempt was made to apply this principle practically the Chicago City Railway Company resisted the encroachment on its territory and wrecked the car which was driven upon its tracks.

The Chicago General Company instituted suit against the Chicago City Company, claiming damages for the destruction of its property and asking for an injunction restraining the latter so that the complainant might operate its cars on defendant's tracks without interference. The application has been dismissed by Judge Tuley.

The accompanying opinion is of great length, but it contains many points of great interest, some of which may be briefly noted.

After summarizing the facts, Judge Tuley says:

"One contention of the complainants is, that they have the right to run their cars over defendant's track, without defendant's consent, because under Section 12, Article 11, of the State Constitution, all railways constructed in this State are 'declared public highways, and shall be free to all persons for the transportation of their persons and property thereon under such regulations as may be prescribed by law.' If the true construction of this provision is, that railway tracks and rights of way become public highways in the sense that a road or street is a public highway, which any person can use with any vehicle that he thinks proper, then there was no necessity of complainant's obtaining either a legislative or municipal act in order to exercise the right of running cars on or over defendant's tracks, whether the same were laid in a street or on defendant's private property. This Court cannot conceive how it can be seriously contended that such is the true construction of the constitutional provision. Nor can it be perceived how this provision added to or gave municipalities any special power over railways, as public highways, which they did not heretofore possess. The complainants rely also on the constitutional provision, Art. 2, Sec. 14, providing that 'No law . . . making any irrevocable grant of special privileges or immunities, shall be passed.' The Constitution of the United States uses these words: 'Privileges or immunities,' in Sec. 2, Art. 4, in declaring the rights of citizens of one State in the several States of the Union, but the meaning of these words has not as yet been conclusively settled. Cooley Const. Lim., p. 491. The provision has been held by our own Supreme Court as not to prohibit a municipality granting the use of streets for railway purposes and annexing conditions thereto. It is true that rails and roadbeds in the street are, as well as the cars, property affected with a public use, in that they are a part of the machinery for the transportation of all persons who may desire to be carried, but this does not make such property a part of the highway, or confer ownership upon the public. It may as well be said that the public own the public grain warehouses because every member of the public has the right to have grain stored in them at a reasonable price, and under reasonable rules and regulations. If we concede complainant's contention upon this point, it does not follow that the city could repeal, in whole or in part, an ordinance granting a privilege to lay tracks in a street without making compensation for the injury done by such repeal.

"It appears also to be a contention of the complainants, that as the city owns the fee of the street, if any one puts a rail down in the street and affixes it to the freehold, it becomes part of the freehold, and as the freehold belongs to the public, the rails that he affixes belong to the public, and therefore that complainant, as one of the public, has the right to use the rails so laid in the street; that such rails become as much a part of the street as the wooden block pavement laid therein. While the presumption of law, in the absence of proof, is, that the city owns the fee of the street, yet as a matter of fact, it does not in many cases. It acquires streets in various ways, by purchase, gift, condemnation, dedication, statutory and common law; and it often occurs that different parts of one street are acquired in several, if not in all of said methods. In such case, if the contention of the complainants could be sustained, the city would own, and the public have the right only, in those sections of the railway under which the city owned the fee, and private owners of the fee in the remainder of the street, the balance of the rails.

"So far as the question at bar is concerned, it makes no difference whether the city does or does not own the fee of the street. The power and right of the city to control and regulate the streets of the city, is just as great where it acquires the perpetual use of the street by common dedication, as where it has acquired, in any way, the fee. In either case, it holds the street in trust for use as a street, and the public as to transportation or passage or user of the same, have the same rights in one case as in the other. It is clear that whatever right the complainant has to use the defendant's track, it must derive from the ordinance granted it by the City Council."

The conclusion of the opinion is as follows:

"The defendant obtained permission and authority to lay its tracks down on Twenty-second Street, and to run its cars over the same under a valid ordinance for a valuable consideration. It has laid the tracks and run its cars over them for several years. It has obtained not only a binding contract with the city, under the decisions of our Supreme Court, but an easement in the street, and has a property right in the rails so laid and the user thereof, of which it cannot be deprived, except upon just compensation as ascertained (and paid), as provided by law. To hold otherwise would be to hold that the vast interests of horse railways in this city, amounting to many millions of dollars, are held subject to the whim, caprice or 'mercy' of the City Council.

"To protect the rights of private property is the duty of all courts. In truth it may be said that the continued existence of our civilization depends upon the protection of private property. The bill in this case must be dismissed for want of equity, at complainant's costs."

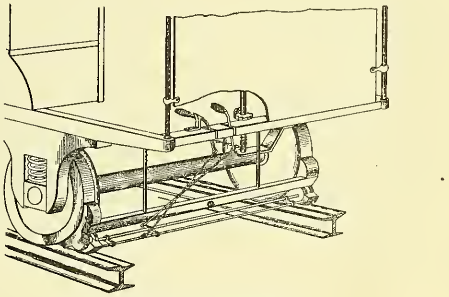
London Underground Electric Railway.

The report of the City & South London Railway Company, which operates the underground electric railway in London, shows that during the six months ended June 30, 3,113,000 passengers were carried. This is a decrease of 270,000, compared with the traffic for the corresponding period of 1894. The following extract from the reports gives some interesting figures:

"The working expenses, comparing this half year with the corresponding period of 1894, amount to 61.5 per cent. of the receipts, against 61.69 per cent. last year, showing a small decrease; or, if we take off the cost of the lifts, as we generally do, the amount is about 52 per cent., which is a fairly low rate of working, although we hope to get that very much lower some day. The locomotive expenses per train mile are 6.10d. this half year against 6.22d., showing a satisfactory decrease. If you deduct, as we have done before, the carriage of it comes out at about 4¾d. The train miles run show a decrease of 3,104 in the half year. The receipts per train mile have risen from 2s. 1½d. to 2s. 2⅕ d. this year, in consequence of the increased fares charged, which were explained at our last meeting. The receipt per passenger has also risen from 1.61d. to 1.82d. The average number of passengers per train, on the other hand, has decreased from 48½ to 46¼, including an estimate for the season ticket holders. The total number of passengers shows a very distinct and decided falling off. This is no doubt partly owing to the increased fare charged and partly to the extraordinary fine weather we had in the last three months of the half year. As you know, fine weather does not suit this railway. You will perhaps observe that there is no mention in this report of any progress being made in the direction of putting on motor car trains. The reason of that is that although we told you last half year that we had a motor car train, and that it was running, and was satisfactory as far as it went, our experience of it has not made us very anxious for the conversion of the rest of the stock. It is a very expensive operation, and will take a long time to do, and there are definite reasons why we think it should not be carried out at present."

Combined Wheel and Track Brake.

The combined brake shown in the accompanying illustration is designed to be attached to the frame of the car in the ordinary way, with the exception that the brake beam to which the brake shoes are attached is pivoted at a point in a plane below the centre of the wheels, so that the track shoes which are pivoted to ears on wheel shoes will come in contact with the rails when the brake is applied. Two parallel rods extend the full length of the brake beam, one of which is located in perforations in the wheel shoes, and the other movably connects the track shoes to and independent of the movement of the wheel shoes. A series of links, which are perforated near their ends, are mounted on the parallel rods and have upwardly extending rods connecting them with foot levers on the platform of the car.



WHEEL AND TRACK BRAKE.

In operation the wheel brake shoes are applied by a crank and the usual brake gearing, and in case of emergency the track shoes are instantly brought in contact with the rails by means of the foot levers on the platform. The brake is released by a pressure of the motorman's foot on the other lever. A patent for the brake has been granted to John B. Hoagland, Benjamin W. Thornhill and Jacob M. Kinsey, of St. Louis, Mo.

Investigation of Street Railways.

The special legislative committee which has been investigating the street railways of New York State finished its labors in Brooklyn last week. No testimony of special interest was taken. The chairman, Mr. Nixon, has intimated that as a result of its investigations the committee may recommend that hereafter cities lease franchises for a period of ten years, at the end of which time the property will be properly appraised and conveyed to the company's successor. In this way, he said, a very substantial revenue would be obtained that would be of importance in the reduction of the municipal tax rate. Mr. Nixon believes he will make some recommendation against the watering of stock.

Freight and Passenger Electric Railway at Bowling Green.

The Park City Electric Railway Company, of Bowling Green, Ky., is constructing an electric railway from the boat landing on the Bannen River to the Fair Grounds. The road will be about four miles in length, and will carry both passengers and freight.

The company owns about 13 acres of land, on which are seven buildings in addition to the power house, and the entire wharf frontage of the city. Five steamers stop at the landing regularly, and the freight business amounts to more than 100,000 tons annually, all of which will be handled by the new electric railway.

The power house will be a substantial, fireproof brick building, measuring 40 x 70 feet. The engine room will contain two tandem compound engines, of 115 hp each, built by Dick & Church, of Meadville, Pa., and two 115-hp generators supplied by the Commercial Electric Company, of Indianapolis, Ind. Steam will be supplied by two 125-hp boilers. The rolling stock will consist of four 16-foot passenger cars, built by the Barney & Smith Car Company, and seven trail cars, furnished by the John Stephenson Company and Brownell Car Company. The motor cars will each be equipped with one 30-hp motor, supplied by the Card Electric Company.

The road will also be provided with four freight cars, each equipped with 25-hp Card motors. The construction is being pushed as rapidly as possible, and it is expected that the line will be in operation by the first of September.

The bonded indebtedness is $50,000. Mr. M. H. Crump, of Bowling Green, Ky., is secretary and managing director of the company.

Electrolysis of Pipes.

In a paper on electrical interference read before the Northwestern Electrical Association's recent Chicago meeting, the author, Vaughan Abbott, referred somewhat at length to the electrolysis of pipes caused by escaping street railway currents. He said among other things: "It is probably impossible to expect an immediate change to the double trolley, or the adoption of any conduit system which would necessitate the use of two conductors. Thus, for some time to come, the various underground structures in the city streets will be menaced from the presence of street railway currents, and as a protective measure a supplementary conductor attached to the electropositive points may be introduced as a palliative, if not a complete remedy. Inasmuch as street railway loading varies from time to time with the changes in the traffic on the system, it is necessary to keep a constant supervision over underground metallic structures, in order to see that they are constantly protected and that changes in the loading do not introduce additional points of danger."

Asleep on a Track.

A Brooklyn grocer was recently arrested for blocking an electric car. He was driving a wagon on the tracks slowly and paid no attention to the clanging of the gong or to the shouts of the motorman. When arraigned in the police court he excused his offense by saying he was asleep. He was discharged with a reprimand.

Street Railway Engineers.—XVI.

G. W. KNOX.

Mr. G. W. Knox, an engineer of broad experience in the electrical field, is at the head of the electrical department of the Chicago City Railway Company, which will eventually operate about 160 miles of electric railway in the city of Chicago. Mr. Knox was educated at the Northern Illinois College, at Fulton, Ill., finishing his course in 1885, when he engaged with the Chicago, Burlington & Northern Railway Company, operating between Chicago and Minneapolis. He was employed in the mechanical department, and supervised the construction of depots all along the line. Two years later he accepted a position in the street car department of Pullman Palace Car Company, at Pullman, Ill., where he was engaged until the following year, when he entered the employ of the Thomson-Houston Company and worked upon several of the first electrical equipments that went west of the Mississippi River. In 1889 he entered the service of the Sprague Electric Railway & Motor Company, with headquarters at Chicago, having charge of the electrical equipment of cars built at the Pullman shops for use on electric roads in different parts of the country. In the Spring of 1890 he was employed by the Sprague Company in the electric installation of the Becker or West Side line in Milwaukee. He was given charge of the motor car equipment, and also was engaged on line and station work. Mr. J. H. Vail was then chief electrical engineer of the Sprague Company, and at this time in Milwaukee, under his direction, an application of the three-wire system was made to street railway work. This was the first effort in this direction in the West, if not in the country. The experiment was fairly successful, but the application was abandoned because difficulty was found in making the different divisions of the line balance, and because also at that time simple shunt dynamos were in use. When the Milwaukee installation was finished in the Fall of 1890, Mr. Knox was sent by the Sprague Electric Railway & Motor Company to Minneapolis and St. Paul, where he served as assistant to the chief engineer in charge. The work in these cities was of great magnitude. The contract called for car and station equipment for over 200 miles of road, and was, in fact, one of the largest of the kind ever let. The interurban line running between Minneapolis and St. Paul was equipped with electric cars which were at that time considered remarkably speedy, as they were geared up to 25 miles per hour. This line connecting the Twin Cities was one of the first to enter into active competition with steam roads. It was believed by the steam railway companies that the rivalry of the electric line would have little effect on their traffic, but the contrary was very soon apparent. In six months from the time that the electric line was opened, twenty interurban steam trains were taken off the road and gave way to the electric lines. After the Minneapolis & St. Paul installation had been completed in May, 1891, Mr. Knox was sent by the Edison General Electric Company, which had purchased the interests of the Sprague Electric Railway & Motor Company, to Milwaukee, as assistant to the chief electrical engineer in charge of the Milwaukee, Wis., installation. The contract which had just been let in that city called for the equipment of all of the remaining local horse car lines forming the Cream City and Milwaukee City railways, and owned by the Villard syndicate. Mr. Knox remained in Milwaukee until the following Fall, and was then engaged in special work for the Edison General Electric Company. He installed electrical equipments in Cincinnati, Columbus, Newark, Lincoln, Neb., Springfield, Ill., and St. Joseph, Mo., and other cities. In the Spring of 1892 he was employed in overhauling the electrical equipment of the Dubuque Street Railway. This road had been operated by storage batteries, but a contract had been awarded to the Edison General Electric Company to convert it into an overhead trolley system. In the Fall of 1892, Mr. Knox was sent by the Edison General Electric Company to Kansas City to take charge of the conversion of the Kansas City elevated road from a steam to an electric railway. The installation was an unusual one, as on the one road cars were operated on the surface, through a tunnel and on an elevated structure. While engaged in Kansas City Mr. Knox was tendered a position with the Chicago City Railway Company, which had just decided to equip electrically its horse car line, and accepting the offer, he assumed his new duties in January of the following year. The immediate equipment of several of the company's lines was made necessary, in order that the World's Fair traffic might be properly handled. The work was executed with the greatest expedition, and it was found necessary to string wires night and day up to the time of the opening of the exposition in May. At this time all the lines required for carrying visitors to and from the fair grounds were ready for business. Despite the fact that it was found necessary to execute the work so hastily, the installation was successful in every particular. The crowds of people which were carried to the connecting cable lines and to different parts of the city on the electric cars have probably never been exceeded for the amount of equipment in service, but the system was operated without a single breakdown throughout the entire season. The greater part of the electrical apparatus for the electric lines of the Chicago City Railway has been designed especially for its use, and as the liberal and far-seeing management of the property determined not to economize in the purchase of machinery either with respect to quality or quantity, an equipment has been secured which the engineers of the company believe is second to none in the country. They state that during the two years and one half of operation, a delay serious enough to be called a shut-down has not occurred, and at the same time the cost of repairs for apparatus has been kept at a minimum that is highly gratifying to the company. When the lines of the Chicago City Railway Company are fully equipped, about 160 miles of electric road will be in operation. The engineering department has computed all its own estimates for the work, planned all its feeder distributions, etc., and has not called upon outside talent for any assistance. In the equipment of the system many new devices and specialties for the line work and track work have been designed, and the system is one of the most interesting as well as one of the best equipped in the country.

G. W. KNOX.

Reduction of Taxation Asked For.

The Brooklyn Elevated Railway Company having failed to induce the local board of assessors to reduce the assessment on its property has applied to the courts for relief. Judge Gaynor has granted a writ of certiorari directing a review of the action of the board in fixing the amount of assessment. The company claims that the true value of its property, which has been assessed at $3,375,121, is only $1,709,558. The company claims that the assessments are illegal, in that the amounts include as an item of value the franchises and privileges pertaining thereto. The company says property has been taxed as though it were new, whereas it has greatly deteriorated in value owing to the wear and tear of continued usage. The company calls especial attention to the allegation that its property has also greatly deteriorated in value, owing to the granting of franchises for the electric roads, which are not taxed as real estate, though they, as are the elevated roads, are an additional burden on the public streets. Not only has the advent of the surface electric roads increased the assessed valuation of the elevated's property, it is claimed, but it has greatly diminished its revenues since the year 1890, when its assessed valuation per mile was $170,000. Furthermore the company claims that through the granting of the franchises to the electric roads the securities of the elevated company have greatly depreciated, from 20 to 60 per cent., and that the value of its real estate is not now equal to what it was in 1890 by 50 per cent.

Pittsburg Consolidation.

A dispatch from Pittsburg announces that the Central Traction Company has agreed to join in the local consolidation plan.

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INVESTIGATION OF RAILWAYS.

The Assembly committee which has been investigating the street railways of New York State has finished its labors, and a report embodying its recommendations will be transmitted to the next Legislature. It cannot be said that the committee's work has been productive of results proportionate to the expense it has incurred, but perhaps the members have been provided a pleasant junket at the cost of the State, and that appears to have been the main object in creating the investigating body. The chairman of the committee has learned, among other things, that the existing methods of financing street railway properties are not above criticism; the stock is watered to too great an extent, he states, so that the true value is difficult to determine. This discovery is not original with the committee, and the last two years have disclosed many of the mischievous consequences of overcapitalization. What remedy will be proposed for the evil remains to be seen.

It is also stated that the committee will recommend that street railway franchises be leased for periods of ten years only, instead of being sold for a long term of years. Were a law to this effect in force street railway companies would naturally make as few improvements as possible, and squeeze the last cent out of their properties. Such a stand-still policy would be detrimental to the interests of the public. Mr. Nixon's committee must make better recommendations than these, if any value is to be attached to them.

GOOD WILL OF THE PUBLIC.

To what length should a company go to retain the good will of the public or to regain it if it has been forfeited? The management of some of the Brooklyn companies would doubtless answer that to achieve this result it is wise policy to make very considerable concessions. Whether rightfully or wrongfully the Brooklyn street railway companies certainly aroused the bitterest opposition by their attitude during the great strike of last Winter. The hostility has made itself felt in decreased receipts and, by influencing the Board of Aldermen, has made favorable local legislation difficult, if not impossible to obtain. Some of the recent changes in management are, without a doubt, to be accounted for on the assumption that the owners of the properties felt it wise to have representatives in charge who were not identified in the public mind with the troubles incident to the strike. The most noteworthy illustration of the policy of conciliating the public came to light this week. The Brooklyn Heights Company has entered into a formal agreement with the local labor union, in accordance with which it agrees to give its former employees who left at the time of the strike preference when they make application for reinstatement. This action has occasioned some little surprise and criticism. It has been said, for example, that "when it is considered that the

Brooklyn Heights Railway Company spent in the neighborhood of half a million dollars for the purpose of breaking the hold which the Knights of Labor had upon the management of the company, that for the same reason the Long Island Traction Company has been forced into bankruptcy and reorganization, that because of this disagreement between organized labor and capital the city of Brooklyn was compelled to spend thousands of dollars to protect the property of the public, that residents of the city were for three weeks so terrorized by the strikers and their friends that they feared to ride in the cars of the surface railways, it seems a strange move on the part of the new management to make any terms or to treat in any way with the old organization of the railroad employees." The company would doubtless reply to this criticism that the opposition to it has made itself felt so keenly by causing a decrease in its receipts from passengers that its action in receding from its former position of hostility to the old employees was justified and a proper concession to public opinion. Time will disclose whether too high a bid for popularity has been made. At the same time, we trust that the management contemplates no plan, as a result of the agreement, for the displacement of the men who went to its assistance at the risk of their lives at the time of the strike. If it follows such a course it will certainly lose far more by forfeiting the esteem of fair-minded men than it can gain by making peace with the labor union.

PROPERTY IN TRACKS

A decision of general interest involving the right of a street railway company to use the tracks of another company without securing the consent of the latter has just been handed down by a Chicago court, and a summary of the principal findings appears elsewhere in this issue. The principle underlying the contention of the complainant is of rather startling novelty. Finding itself unable to secure a desired outlet for its cars, the plaintiff company came to the curious conclusion that it possessed the right to run them over the tracks of another company, although the latter had refused to make an agreement to this effect. It argued that the streets were provided for purposes of transportation, and that they should be as free for the passage of its vehicles as for the use of wagons and carriages belonging to other companies and private individuals. An attempt to test the correctness of this principle under conditions of actual practice did not meet with signal success. An army of employees was organized to resist the invasion of the company's car. When it was driven upon rails that did not belong to its owners, it received rough usage, and was so battered and damaged that it could not proceed.

To prevent the recurrence of incidents of this kind the company applied to the courts for an injunction, but Judge Tuley, in the decision referred to, has refused to grant the restraining writ. In a voluminous opinion he has pointed out the facts which the complaining company had disregarded when it formed the conclusion that it could arbitrarily and compulsorily send its cars over the tracks of another corporation. These grounds need not be summarized here, but it may be noted that the conclusion of the court was to the effect that the defendant, having obtained a binding contract from the city, owned an easement in the street. After having laid the tracks and run its cars over them for several years, it had a property right in the rails and the use thereof, of which it could not be deprived except after just compensation had been ascertained and paid as provided by law. Few persons will experience any surprise in noting this conclusion of Judge Tuley. A contrary finding would have practically affirmed the belief that franchises convey absolutely no rights, and are therefore absolutely valueless. It would seem to follow as a corollary of such a conclusion that new companies could start in business at any time or in any place where it could find street railway tracks on which cars could be operated without waiting to ask for privileges from authorities or from the owners of the rails. Such a decision would indeed tend to destroy property which courts are organized to protect. While the decision of Judge Tuley is full of interest, it would perhaps be going too far to say it was significant, for the simple reason that few intelligent persons could fail to anticipate the conclusion at which the court arrived.

Report of the Louisiana Arbitration Board.

The Louisiana State Board of Arbitration, which has been investigating the alleged grievances of the New Orleans street railway employees, has reached a decision which, in the main, sustains the position of the companies. The principal findings of the board are as follows: The charge that men were discharged for testifying in the investigation is declared not proven. In reference to changes in the schedules alleged to have caused hardship to the men, the board found the charge true in reference to some of the schedules, "but it has not been clearly shown that regulation of schedules was entirely optional with the company. At the same time every effort should be made by the officials to see that the schedules do not work unnecessary hardships.

"It has been proven that at some of the railway barns proper or necessary accommodations were not afforded the men. In this connection, it is in evidence that the companies are now applying the correctives as speedily as practicable. This board considers and suggests that the company should provide conductors with funds to make necessary change. This board recommends that the company allow legal interest on the $25 deposit of the men. It is the opinion of this board that the charges for uniforms are reasonable. The evidence before this board with regard to regulations of time, or, in other words, the clocks at the different ends of the lines by which the cars run, has not been entirely satisfactory, as it was shown that the clocks differed, rendering the men liable to suffer through no fault of their own. The requirement that conductors and motormen shall have watches is reasonable. The board is clearly of the opinion that the company should give the men every opportunity to answer and defend themselves as to liability for accidents or damage to cars or to the persons or clothing of passengers, and that any refusal to allow the men a prompt and full hearing would be, to say the least, unjust. Employers have a right to employ whom they choose, and their refusal to employ men because they belong to the union or for any other cause cannot be construed in the light of a discrimination. This applies to qualification required of men before their employment. (Two members of the board opposed this finding.) It is the opinion of this board that an employee, in the event of being unable to represent himself, should be permitted to select an agent to represent him in the presentation of any grievances to the proper officers of the company, and that where time is lost in the settlement of grievances or any charge against him of any kind, he should be allowed proper compensation for said time in the event of his being proven not at fault."

The board declares that, as the Traction Company has just gone to enormous expense in changing its system from mule propulsion to electricity, it is in no condition to increase its scale of wages, in view of the fact that the present rate is not unduly low. Ten hours is the working time required of the men, and this is not excessive under the circumstances.

Electric Heating.

The Engineers' Club, of Philadelphia, recently discussed the question of electric heating. J. Chester Wilson, who read a paper on this subject, said in reference to heating cars by electricity, that the cost, according to one expert of the Edison Company, ranged from 12 to 18 cents per car per day. Car stoves, he said, cost from 25 to 35 cents.

James Christie, in the discussion of the paper, said he had recently investigated electric car heating. The cars in question were the ordinary 16-foot bodies, each having four Burton heaters under the seats. The heaters were connected in series, each having a resistance of 35 ohms. These required for each car 3½ amperes of the 500-volt current. Allowing for the usual losses, this could be traced back, he said, to an equivalent of three hp per car--at the station engine—or in the case under consideration, to 12 pounds of anthracite pea coal per car per hour at the boilers. The value of this fuel was 1.3 cents in the fire-room. Charging this item with its share of the general expense of labor and maintenance, made the cost of heating the small cars about 1½ cents per car per hour.

George S. Webster asked whether the heating of cars by electricity could be considered entirely successful; and whether a good deal of trouble was not experienced because heaters were too hot at times, even to such an extent as to set fire to ladies' dresses, while in other cases the heat was insufficient?

Mr. Wilson replied: "That is one of the troubles, and might be looked after a little more carefully by the man at the wheel. The wire switches should be of such a type that the heat could be easily reduced, because in some parts of the line under certain conditions of the traffic, the heaters would probably get a little more charge than at other parts. Just what is needed in these things is of interest, and there will be accidents until the switches are a little more elastic, and give a greater opportunity of cutting off, through resistance, or cutting down the coils. The switches that are now used are intended to reduce to two coils in a car equipped with six; another switch to put in four, and another to put in six; with the proper attention there would be no occasion for complaint."

Carl Hering said: "When electricity becomes cheap enough, I have no doubt that the present form of heating will be almost wholly abandoned. Electric heat can be regulated to such nicety that economy is possible with this system that with no other systems can be realized. I think wherever there has been trouble in the heating of railway cars electrically, as has been stated, it has been due to the fact that the apparatus has not been properly arranged. There is no reason why there should be the slightest difficulty about regulating the electric heaters in trolley cars."

Mr. Pike said: "The question of heating cars electrically is one which is apparently very easy of solution; but when you consider cities situated as those of northern New York or farther north, the question becomes different and more serious. The figures given by Mr. Christie, of three amperes per car, are not far from correct for cities farther south. Now, the number of horse-power used per car varies somewhere from 6 to 8 or 9, according to the nature of roadbed and traffic. For instance, three or four years ago, in Boston, the amount of territory covered, and the nature of it, was such that the average horse-power per car was about 6, that is, it would require between one third and one half as much power for the heaters as to run the cars. The heaters do no more than take the chill off. I do not believe, therefore, that any railway company operating in the northern cities either does attempt or would attempt to really heat its cars electrically; but in cities like Philadelphia, Washington, Baltimore and other cities, the system becomes feasible and much more advantageous than coal-stove heating."

James Christie said: "We find electric heaters in the street cars of Montreal and Ottawa, probably the coldest regions where electric cars are operated. In the latter city an abundant water-power allows the companies to offer inducements for the use of current, for domestic culinary purposes. One gallon water heaters, 50 cents per week, for rent of heater and use of current; or 25 cents per month rental; and current by meter, 8-10 cent per ampere-hour. Stoves owned by consumer, ½ cent per ampere-hour."

George M. Sinclair said: "I understand that one horsepower can be supplied for 10 hours per day at an expense of $25 per year. At that rate the receipts of a single car for two or three days would be sufficient to heat it for a year."

Steam Dummies Used on West Chester Turnpike.

The Delaware County Passenger Railway Company, of Philadelphia, is operating steam dummies on the West Chester Turnpike, between the city line at Sixty-third and Market Streets and Newton Square. Dummies will be used until the necessary consents to operate the line electrically are secured.

The Employment of Two or Several Motors on Cars or Locomotives with Respect to Skidding.—II.

BY PAUL HOHO.

Consider now a locomotive on three or four axles, of which two axles each has its own motor. If the axles are not rigidly connected—which is generally impossible for various considerations—the division of the weight is absolutely independent of the levels which these axles occupy. In a given moment one of the two motors may find itself elevated, and however feeble this may be, it will cause a very considerable diminution in the pressure on the axle. Then, whatever calculations may have been made as to the ratio of the slipping resistance to the total rolling resistances of the entire train, the normal resistance, Q_1, can very easily go below the value $\frac{R_1 + R_2^1)}{2}$ and skidding becomes certain.

I have had occasion to see this fact verified with a locomotive of this kind. The skidding of one pair of wheels was produced always at almost the same places—which is besides a logical consequence of what precedes—though at first sight the conditions of the locomotive seem to exclude the possibility of skidding.

It can be understood that the condition of skidding (Q_1 or Q_2 being less than $\frac{R_1^1 + R_2^1)}{2}$ can be produced momentarily; the train will continue by its inertia for a certain distance, during which one of its pairs of motor wheels will slip while at the same time rolling, but the locomotive, having advanced a certain distance, the condition of skidding, $Q_1 < \frac{R_1^1 + R_2^1}{2}$, may cease to exist, and, in that case, the train will continue as before. This state of things can repeat itself more or less frequently. With these conditions there will be partial slippings and skiddings absorbing more or less energy uselessly, the total, however, assuming considerable importance.

It was remarked above that the employment of two or several motors instead of a single one will diminish the efficiency considerably. In fact, *a priori*, two or three motors of N hp give an efficiency less than that of a motor of $2\,N$ or of $3\,N$ hp. In addition, the multiplication of parts augments the frictional losses. These causes exist then, but they are not sufficient to explain, by themselves, the extraordinary differences which have been found by certain experimenters, according to which the employment of two motors of N hp in place of one motor of $2\,N$ hp diminishes the efficiency to an amount as high as 60 per cent. or more. These considerable losses cannot be explained otherwise than by partial slippings and skiddings frequently repeated, and which are not directly perceived. To the preceding conclusions another aggravating circumstance can be added. I have implied that the two motors have identical magnetic fields. If these fields are excited in series, or if they are excited by the same shunt current, or from currents shunted from the same points of the circuit and circulating in identical exciting coils, the hypothesis is exact; but if each motor is individually excited—partially or totally—by a shunt current taken from its own binding posts, this current is proportional to the fall of potential between the terminals. In this case, the current, and, consequently, the intensity of the magnetic field, increases with the speed of the first motor and diminishes with that of the second. Now, the torque exerted is proportional to $K \mathcal{H} i$; the torque increases, then, for the motor which has a tendency to slip, and diminishes for the other, which continues at work and exerts for that reason a still greater torque.

B. The Two Motors in Parallel. Under these conditions the operation of the two motors is still independent of each other. To overcome the resistance, R_1, the current of the first motor will have an intensity such that $K \mathcal{H}_1 i_1$ is equal to R_1; while the second motor overcoming the resistance, R_2, will have an intensity given by $K \mathcal{H}_2 i_2 = R_2$. But under these conditions the speed will be, respectively, for the first motor,

$$n_1 = \alpha \frac{e_1}{\mathcal{H}_1} = \alpha \frac{E - T_1 l_1}{\mathcal{H}_1},$$

and for the second motor,

$$n_2 = \alpha \frac{e_2}{\mathcal{H}_2} = \alpha \frac{E - T_2 l_2}{\mathcal{H}_2},$$

where E is the total E. M. F., e_1 the E. M. F. of the first motor, e_2 the E. M. F. of the second motor, r_1 the electrical resistance of the first motor, r_2 the electrical resistance of the second motor, $\mathcal{H}_1$ the intensity of the magnetic field of the first motor, $\mathcal{H}_2$ the intensity of the magnetic field of the second motor, and α a constant depending on the motor.

We have here three cases to distinguish: 1. The motors are excited in series. 2. The motors are excited in shunt. 3. The motors have a compound excitation.

1. In the first case the intensity of the magnetic field will be a function of $\mathcal{H} = \mathcal{H}_{sat} \times \frac{N\,i}{N\,i + h}$ and, therefore, essentially variable, $\mathcal{H}$ being the intensity of the magnetic field when saturated, $N\,i$ the number of exciting ampere-turns, h a constant equal to the number of ampere-turns which produce half saturation (critical point).

The speeds become, respectively,

$$n_1 = \alpha \frac{(E - r_1\,i_1)\,(N\,i + h)}{\mathcal{H}_{sat}\,N i_1}; \quad n_2 = \alpha \frac{(E - r_2 i_2)\,(N\,i_2 + h)}{\mathcal{H}_{sat}\,N\,i_2}.$$

The speeds of the two motors would thus be essentially different, since the resistances offered are different. But the motors are forcibly constrained to the same speed; from which it follows, having given the preceding relations (where n_1 becomes $= n_2$) i^1 will become i^2, the two motors will exert the same torque, and, as in the preceding case, A considered, the resistance to be overcome will be equally divided between the two motors, or

$$R_1^1 + R_2^1 = \frac{R_1^1 + R_2^1}{2}.$$

It is to be remarked that thus far we have arrived at the same conclusion as with two motors in series, though the fundamental causes are exactly opposite. Here, happily, the similarity between the two cases ends.

Continuing the same notation as precedes and the same hypotheses, suppose that the resistance to slipping, Q_1, becomes at a given moment less than R_1^1, that is to say, less than $R_1^1 + R_2^1$. The first motor will encounter a less resistance to slipping than to rolling, and there will be slipping and skidding, at least partial. It will continue in motion on account of the inertia and the torque of the second motor, but it will not in itself act to overcome the rolling resistance. The second motor then will encounter the total rolling resistance.

Now, here the current acts on second motor entirely independently of the first, which distinguishes this case from that of case *A*; it will become the value $i_2^1 = K\mathcal{H} i_2^1 = R_1 + R_2$; that is to say,

$$K\mathcal{H} i_2 = \frac{K i_2^1 \mathcal{H}_{sat} N i_2}{N i_2^1 + h} = \frac{K \mathcal{H}_{sat} N i_2^2}{N i_2^1 + h} = R_1^1 + R_2.$$

The speed will be

$$n_2^1 = \frac{\alpha (E - r_2 i_2^2)(N i_2^1 + h)}{\mathcal{H}_{sat} N i_2^1}$$

The current will be increased, the speed will diminish, both in a proportion which depends principally on the saturation of the magnetic field, but it is not a case of complete slipping, as in case *A*.

The difference between the two cases, *A* and *B*, will be remarked; that is to say, when the motors are coupled in series or in parallel. In case *B*, when slipping is produced, one or other of the motors increases its torque in order to overcome the total resistance which it has to encounter independently of the first motor; while in case *A*, when either motor is subjected by slipping to a resistance less than the normal resistances, all the other motors are affected by the feeble resistance, and tend to stop in unison with the resistance which they encountered themselves, permitting the first motor to turn alone, whether at rest or at any speed.

With the motors disposed of in parallels, cases of *partial* slipping are not excluded, as we have seen.

2. When the magnetic fields of the motors are excited in shunt, the intensity of these fields is constant, or at least very approximately, so $\mathcal{H}_1 = \mathcal{H}_2$ whatever may be the value of *i*;

$$n_1 = \frac{E - r_1 i}{\mathcal{H}_1}; \quad n_2 = \alpha \frac{E - r_2 i_2}{\mathcal{H}_2},$$

In examining this case from the purely theoretical point of view, figures not being considered, the same result is arrived at with respect to the mode of operation as in the preceding case, but in reality the values of r_1, i_1 and r_2^1 and i_2^1 which constitute the loss of E. M. F. in the armatures of the motors are always very small compared to *E*, and consequently the counter E. M. F. and the speed vary very little when the intensity of the current varies; the effect of the differences of intensity on the speeds of the two motors is, besides, so small that it is often compensated for in part by small inequalities of construction which may exist, or differences in the quality of the iron in the magnetic field, or heating of the motors varying the resistance of the copper. These small differences, on the other hand, and for the same reason, lead very easily to differences of intensity between the motors which may be notable, so that one of the motors may work under a greater load and the other under a less load.

3. Compound-excited motors possess the combined properties of motors excited in series and in shunt. It is then easy to take account of their working. From the point of view which we have here taken, they will hold a position midway between the two other classes of motors.

C. Very often the two motors are connected to a controller combined in such a way that it permits their being put in series or in parallel. This combination permits the speed to be varied in a manner depending upon the method of excitation and upon the saturation of the magnetic fields, and this circumstance even constitutes one of the reasons which often leads to the employment of two motors. However, means for varying and regulating speed are not lacking.

D. As a matter of information, I will add the following disposition, which corresponds in fact to the three-wire system of electrical distribution of energy. The two motors are coupled in series; the positive pole of the first and the positive pole of the second are then united in series to the two poles of the source of electricity, while the negative pole of the first and the positive pole of the second are connected together. But, independently of that, a neutral wire connects the wire joining the two motors, to a pole which is neutral to the source of electricity; that is to say, to the point of the source of electricity which divides the latter into two equal parts. With this disposition, the two motors, though coupled in series, receive a current from two independent sources of electricity; they are, therefore, absolutely independent, exactly as in the case of two motors in parallel. In practice, it would be little rational to apply to the motors of a single car this disposition, which, though excellent for the distribution of electrical energy over a considerable territory, would be very difficult of application in this case.

To resume, the employment of two or of several motors on the same car, on the same locomotive, or on the same train, may result, in certain cases, notably when the roadbed is not well cared for, in very serious inconveniences with respect to slipping and skidding. It is true that there are often conditions, such as the dimensions of motors, which render this subdivision necessary. In these cases there should be no doubt as to the manner of grouping the motors, which should be in parallel; and, besides, it is necessary to take all the precautions possible with respect to the division of the load on the axles and the design of the transmission parts, in order to avoid partial slipping.

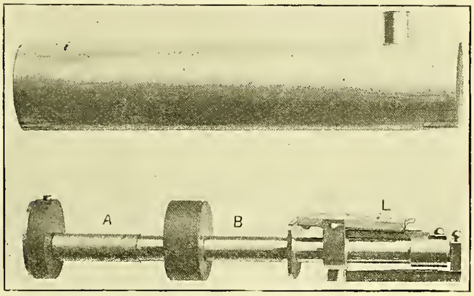
Electromagnetic Railway System.

John H. Guest, of Boston, has patented a conduit railway which forms within itself a natural block system. The railway system belongs to that class in which a sectional surface contact-strip or rail is used to convey current to a collector or brush on a car, each section of the contact-rail being put in connection with the buried main when the car is over it and rendered "dead" after the car passes beyond it. The connection is effected and destroyed by an underground switching device which is controlled from the car.

The main feature of the Guest system is the switching device used for the purpose stated, which is shown by the accompanying illustration. This switching device consists of two solenoid coils operating oppositely upon a common plunger, which operates a switch to connect or disconnect a section rail with or from the feeders, and a soft-iron lever which controls the connection between the supply mains and the solenoids in a manner explained further on. In the cut the solenoid windings are omitted; the space at *A* contains the "killing" coil and the space *B* the energizing coil. When the plunger is at the extreme right of its travel, connection is completed between the feeders and that section of contact-rail nearest which the switch is located. The soft-iron lever is shown at *L*. The mechanism is sealed in a metal tube, and to strengthen or insure the influence of the magnet on the car upon the soft-iron lever in the tube a soft-iron pin is encased in a projection of non-magnetic material, its upper end being flush with the roadway when the switch-tube is buried, and the lower end terminating just above the iron lever. The complete switch-tube is represented by the upper figure in the engraving.

One of these switch-tubes is placed at each break in the surface contact-rail, and a magnet is located about the centre of the car, with its lower end close to the ground. The car is provided with a current collector at each end of the truck, and mounted upon it so as to obviate any trouble by reason of the oscillations of the car body.

The operation is as follows: When a car reaches a point where the break in the surface contact-rail is under its centre, the magnet on the car attracts the soft-iron armature within the buried switch-tube. The armature makes connection between the main line and the solenoid coil *B*, which effects a connection between the supply main and the contact-rail just ahead of the car. The solenoid plunger, while making this connection, energizes coil *B*, of the second switch back over which the car has passed, causing that switch to break connection between its section of rail and the supply main. This break is not attended by a flash because the car has previously made connection through its front collector with the contact rail ahead, and the rail thus disconnected is dead.



UNDERGROUND SWITCH.

This description applies to a system using a sectional contact-rail for one side of the circuit and the regular rails for a return. Mr. Guest proposes, however, to use two lines of sectional contact-rails, with switch-tubes for both, and dispense with the use of the track as a return. In this case the gaps in the contact-rails are staggered so that the gap between two positive contact-rails will be abreast of the centre of a negative contact-rail. Two magnets are used on the car, one for each set (positive and negative) of underground switches, and four current collectors, two on each side. The two lines of contact-rails are laid equidistant from the centre of the roadbed and any desired distance apart, up to three and a half feet.

It will be seen that the block-system feature above referred to is obtained by reason of the "killing" by the underground switch of the contact-rail two sections to the rear of the car, which effectually prevents a car following to approach nearer than about one and a half sections.

Mr. Guest has also obtained patents covering a system in which a trolley line is used overhead and a sectional contact-rail with underground switches as above described, completes the return circuit, the advantage being that the circuit is not grounded and, therefore, the breaking and falling of the trolley wire is not attended with the same degree of danger as in an ordinary trolley system, the contact-rails being dead except at points under cars.

Comments and Views of Contemporaries.

Operating Expenses.—Electric railways have not yet been in operation long enough to fairly test the comparative cost of operation and maintenance, although some claims for great economy have been ventured. A statement of the gross and net earnings of the electric lines in five cities—Buffalo, Columbus, Lehigh, Scranton and Indianapolis—appears to show that the percentage of operating expenses to earnings was, respectively, 53, 51, 58½, 68½ and 59. If these widely varying results may be taken as at all representative they show an average of about 60 per cent., which, compared with nearly 70 per cent., the average of the steam railways of the country, seems favorable. But when the time for renewals of electric appliances has come and gone statistics of expenses will have much more value than they now can possess.—*Railway Age.*

Lack of Progress in the British Isles.—And why is it that tramway progress is almost unknown in the British Isles, while elsewhere, even in other European communities, it is one of the most noticeable features of the past ten years? It is certainly not because English engineers are wanting in skill or enterprise. The few opportunities granted to them at home have been successfully employed, and their achievements compare favorably with modern tramways elsewhere. To find the real reason for our lack of progress we have to go to the legislative and official discouragements that hedge about the promoter of tramway enterprise. There is every reason to believe that the tramway industry would, if properly encouraged, prove as active in England as in America; but it must be able to employ the latest improvements in methods of traction, and to enjoy concessions as liberal as those granted to it elsewhere.—*London Railway World.*

Changed Railway Situation.—Electric lines are gradually becoming continuous between large centres of population, running through town after town; and inevitably they will be consolidated in systems, which will make their competition with the steam roads still more serious, if those are not prepared to meet it by themselves making use of the electric motor. The railway situation has been changed radically by the introduction of the new agent, and the railways accordingly must adjust themselves to the novel conditions or suffer because of them. At present the prospect of the use of electricity in long hauls on the great trunk lines seems at least far distant. Those concerned in this manufacturing combination say that they are not influenced immediately by any such outlook; but they must foresee that eventually the motor which demonstrates its superiority in the more restricted sphere is sure to be adapted and developed for the largest and broadest use. They are making ready for the coming day of the general triumph of the electric motor over steam.—*New York Sun.*

FINANCIAL NOTES.

OGDENSBURG, N. Y.—The Ogdensburg Street Railway Company has increased its capital stock from $70,000 to $150,000.

MONTREAL, QUE.—The gross earnings of the Montreal Electric Street Railway for July were $110,035, as compared with $87,838 for the corresponding month of 1894.

CORUNNA, MICH.—The Owasso & Corunna Street Railway, with all its appurtenances, has been sold to Alexander Ralph, of Philadelphia, for $5,000. The railway, which has been in operation for nearly three years, was capitalized at $40,000.

RECEIVERSHIP FOR THE ST. CLOUD COMPANY.—The St. Paul Title Insurance & Trust Company has applied for a receiver for the St. Cloud (Minn.) City Street Car Company, which has defaulted on the interest on its $125,000 of bonds.

TIFFIN, O.—Sheriff Van Nest has sold the Tiffin Street Railway and the Tiffin Electric Street Railway and appurtenances at public auction. The former was purchased by Joseph Loudenslager, Jr., for $4,010, and the latter by Samuel B. Sneath for $20,000.

INCREASE OF STOCK IN CINCINNATI.—The Cincinnati Street Railway stockholders have voted an issue of new stock to the amount of $1,000,000. The annual statement showed earnings for the year of 6.17 per cent., against 5.94 per cent. for the year ending July 31, 1894.

CONSOLIDATION IN BALTIMORE.—It is believed here that the systems of Baltimore will be brought under one management in a comparatively short time. In fact, there are already indications of negotiations, says the Philaphia *Times*. It is known that the matter has been discussed at conferences between the magnates controlling the roads and that they have expressed themselves in favor of merging the properties. The factor mostly influencing this sentiment is the large saving in expenses which would result from operating all the lines with one set of officers, but there are other reasons why consolidation would inure to the benefit of all concerned.

PHILADELPHIA CONSOLIDATION.—On Wednesday holders of 150,367 shares of the Philadelphia People's Traction stock, out of the total of 200,000, and holders of more than 135,000 shares of Electric Traction stock, out of a total of 175,000, had assented to the plan of consolidation. It is expected that the larger part of the remaining shares will be assented, but sufficient assents have been given to insure the success of the plan. The actual consolidation of all three companies cannot be effected until the lease of the Philadelphia Traction Company goes into effect, which will be, it is stated, about Oct. 1. The special meeting of the stockholders of the Philadelphia Traction Company to act on the proposed lease will be held on Sept. 26.

THE LONG ISLAND BICYCLE RAILWAY PROJECT.—The annual meeting of the Kings, Queens & Suffolk Bicycle Railway Company, which proposes to construct an electric bicycle railway to Far Rockaway, L. I., was held last week. President F. W. Dunton made the statement that $230,000 of the stock of the road had been subscribed, mostly in Long Island, there being 2,000 subscribers to the stock, in amounts ranging from $25 to $1,000. Mr. Dunton stated that of this amount $62,500 had been called for and paid in, of which $5,500 had been used in expenses, the balance being in the bank. He added that with $150,000 in hand it would be safe to make a start in the work of construction, and if the whole amount of the stock was paid in it would be sufficient to build the entire first section from the terminus of the Kings County Elevated Railway to Far Rockaway.

NO AGREEMENT REACHED.—A United Press dispatch from Pittsburg gives a summary of an alleged interview with Mr. Westinghouse regarding the rumored attempt to establish a working agreement on the part of the Westinghouse and General Electric companies. Mr. Westinghouse is quoted as saying that a committee from his company and one from the General Electric Company had discussed the matter of an amicable working agreement. At a meeting last week, Mr. Westinghouse says, an agreement was apparently reached, but afterward receded from by the General Electric Company. The representative of the General Electric Company wanted to enter into an arrangement whereby his company would be assured of a future business somewhat in proportion to the work of last year. This proposition was not accepted by the Westinghouse people, and this ended the negotiations.

GENETT AIR BRAKE COMPANY.—Judge O'Brien, in New York City, has refused the application of Charles Putzel for an order directing the secretary of the Genett Air Brake Company to show cause why he should not exhibit to the former the books of the company. Mr. Putzel is a lawyer, and owns 200 shares of the stock. The company was organized in Illinois, but has offices in this city. Mr. Putzel declares that since Jan. 18, 1893, the directors have met in the offices of J. & W. Seligman, in New York, and that on July 24 last Mr. Straus refused to show him the books. Mr. Putzel declared that the Seligmans have applied for a receiver in Chicago, alleging that they are judgment creditors for $75,000, which, he says, was improperly obtained. He declared that the Seligmans desire to acquire the Genett Air Brake Company's property for the Standard Air Brake Company. James Seligman submitted an affidavit declaring that his judgment against the Genett Company for $75,191 was properly obtained, and that the Standard Air Brake Company is now in active operation, and has no need of the Genett Company.

SPRINGFIELD, ILL.—Articles of incorporation have been filed by the Danville & Northwestern Electric Railway Company, which proposes to construct and operate the railway from the city of Danville, Vermillion County, in a northwesterly direction through the village of Potomac, thence northerly through the village of Rankin, to the city of Gilman, in Iroquois County; with a branch line starting on said proposed line at a point north of the village of Potomac, thence northwesterly to the city of Paxton, Ford County; also, another branch, commencing at a point on said railway west of Danville, thence in a southwesterly direction to Fairmount, thence southerly to Sidell, Vermillion County, thence northwesterly to the village of Georgetown, thence northerly to a point on said line west of Danville. The location of the principal office is Danville. The capital stock is placed at $100,000, and the life of the corporation is fifty years. The incorporators are: William T. Cunningham, John W. Dale, William P. Chandler, W. S. Mathias and Robert Holmes, all of Danville; J. W. Layne and J. K. Butz, of Potomac, and W. W. Hatch, New York City. The first board of directors are: W. T. Cunningham, William P. Chandler, W. S. Mathias, W. W. Hatch and Robert Holmes.

CONSOLIDATION IN WASHINGTON.—It is proposed to consolidate the Rock Creek and Washington & Georgetown railway companies of Washington under the name of the Capital Traction Company with a capital stock of $12,000,000. The Washington & Georgetown company is forbidden by its charter to acquire any other railway property or to increase its capital stock. The proposed consolidation, therefore, is to be accomplished by authority of an act of Congress, approved March 1, 1895, which authorized the Rock Creek road to contract with any connecting or intersecting line for its joint management, lease or purchase, and for its joint operation. In case of such contract, the Rock Creek road was authorized to provide the necessary means "by an increase of its capital stock, not to exceed the actual consideration paid or the actual cost of the necessary equipment; provided that only one fare, not exceeding the rate now authorized by law, shall be charged for a single continuous ride in the District of Columbia over all the lines affected by such contract or any part thereof." The capital stock of the consolidated company is to be distributed as follows: Stock, Washington & Georgetown, par value $500,000; $2,750,000 bonds of same company, par value $4,000,000; $8,000,000 Rock Creek Railway stock, and bonds $1,250,000, making a total capitalization of $12,000,000. The stock of the Washington & Georgetown sells readily for $275 per share.

NEW INCORPORATIONS.

THE NEWARK (N. J.) ELECTRIC DEVELOPING COMPANY, capital stock $100,000, has been formed for the purpose of manufacturing electric appliances and machinery, and for selling the same. The promoters are Augustine Demarest, Eugene Eagles, Charles H. Madison, James H. Reinhardt, Newark, N. J.

THE SEATTLE & RAMER BEACH RAILWAY COMPANY, Seattle, Wash., has been formed to build, equip, operate, buy and sell electric, cable, steam and other railways, boats and other means of transportation. The promoters are Henry Chapin, E. W. Andrews and Josiah Collins, Seattle, Wash. Capital stock $20,000.

THE DANVILLE (ILL) & NORTHWESTERN ELECTRIC RAILWAY COMPANY, capital stock $100,000, has been formed to construct and operate an electric railway. The incorporators are W. T. Cunningham, John W. Dale, William P. Chandler, J. W. Layne, J. K. Butz, W. S. Mathias, W. W. Hatch and Robert Holmes.

THE ELLIOTT MAGNETIC ELECTRIC COMPANY, Chicago, Ill., capital stock $1,000,000, has been organized to manufacture and sell the Elliott magnetic electrical and mechanical appliances for railway and other purposes, and to sell the right to manufacture and sell the said appliances. The incorporators are William R. Elliott, Isaac C. Robbins and Charles A. Emmons.

THE NORTH SUSQUEHANNA TRANSIT COMPANY, Danville, Pa. capital stock $125,000, has been incorporated for the purpose of constructing and operating an electric railway, by E. S. Whitney, Allentown; Robert E. Wright, Allentown; Wilson M. Gearhart, Danville; Edward R. Spousler, J. M. Fitzgerald, Harrisburg; James Scarlett, R. S. Ammerman, and John K. Cerringer, Danville, Pa.

THE LA BURT ELECTRIC RAILWAY COMPANY, New York, N. Y. incorporated in West Virginia, with a minimum capital stock of $500 and a maximum capital of $3,000,000, to conduct, operate and maintain inventions, letters-patent, etc., improvements in the mechanical arts, electrical and other sciences. The incorporators are John La Burt, Brooklyn, N. Y.; Lis Michaelis, Alex. M. Lowery, New York City, and Irving Hull, Bridgeport, Conn.

THE IRON MOUNTAIN RAILWAY COMPANY, San Francisco, Cal., capital stock $100,000, has been incorporated for the purpose of constructing and equipping a railway to be operated by steam or electricity from the Iron Mountain mines to Spring Creek Crossing on the California & Oregon Railway. The incorporators are Louis B. Parrott, Charles P. Ells, M. M. O'Shaughnessy, San Francisco, Cal.; Alfred Fellows, Newcastle-on-Tyne, England, and Charles W. Fielding, London, England.

NEWS OF THE WEEK.

MT. VERNON, N. Y.—A new trolley road is to be built from this place to White Plains.

SCHUYLER, N. Y.—It is reported that the Deerfield Street Railway is to be extended to Schuyler.

NEBRASKA CITY, NEB.—It is reported that the horse-car line is to be converted into an electric system.

OTTAWA, ONT.—Arrangements have been completed for extending the Ottawa Electric Railway to Hintonburgh.

BALTIMORE, MD.—Samuel M. Shoemaker is contemplating the construction of a line from the railway track to Chattalanee Hotel.

CENTRALIA, PA.—A company is being organized for the purpose of constructing an electric railway between this place and Ashland.

CAMDEN, N. J.—The City Council has voted in favor of the ordinance granting the West Jersey Traction Company the right of way in this city.

JERSEY CITY, N. J.—The North Hudson County Railway has applied for permission to operate a trolley line through Grove Street to Hoboken.

OLEAN, N. Y.—It is reported that the Fall Brook Railway Company is to extend its line from Mills to this place, via Honeoye Valley, Cortville, etc.

NEVADA, MO.—The Nevada Electric Light Company has purchased a franchise to operate a street railway here and will add the necessary equipment.

TUSKEGEE, ALA.—An electric road is to be built to Cheraw, a distance of about six miles. The clerk of the Council can probably furnish particulars.

KILLINGLY, CONN.—The Killingly & Brooklyn Street Railway will establish an electric street railway to connect the surrounding villages with Danielson.

SANTIAGO, CAL.—George B. Kerper, owner of the Santiago Cable Railway, will change the system to electricity, and will extend the line to National City.

HERKIMER, N. Y.—The Little Falls & Herkimer Railway has applied for permission to build its railway over the Mohawk River Bridge, East Ridley, to Little Falls.

NORRISTOWN, PA.—The People's Traction Company has purchased land in Moreland and vicinity for the proposed electric railway between Willow Grove and Moreland.

EWING, N. J.—An ordinance has been introduced to authorize the Trenton Passenger Railway to construct, operate and maintain an electric railway through this town.

STOCKTON, N. J.—An ordinance has been passed by the Town Council granting the West Jersey Railway permission to construct trolley lines on certain streets of the town.

BALTIMORE, MD.—Plans have been completed for a new brick power house for the Baltimore, Middle River & Sparrows Point Railway at Fairy Grove. The station will be equipped with the most modern machinery.

WATKINS, N. Y.—It is now announced that the proposed Watkins & Havana Railway is to be constructed to Horseheads and the Elmira line of electric cars. A number of New York capitalists are interested.

WOODBURY, N. J.—The National Park Association officers intend to build a trolley road to run from the park to North Woodbury, connecting with the West Jersey Railway and the Camden, Gloucester & Woodbury trolley road.

GREENSBURG, PA.—The Greensburg, Jeannette & Pittsburg Electric Railway is being pushed forward as rapidly as possible. The public roads are graded from this place to Jeannette, and two and one half miles of track have been laid. It is expected to run the cars shortly.

FRANKFORD, PA.—Nearly all the track and overhead work of the Holmesburg, Tacony & Frankford Electric Railway Company is completed. The power station and car barn are about finished, but the machinery has not yet been installed. Unless some unforeseen hitches occur, the line should be ready for operation by Oct. 1.

CANTON, O.—The proposed street railway from Canton to Akron, and thence to Cleveland by way of the Akron, Bedford & Cleveland road, has now assumed such definite shape that there seems to be no doubt as to its success. The enterprise is backed by W. A. Lynch, of Canton, president of the Canton & Massillon Interurban line.

PHILADELPHIA, PA.—Work on the Fox-Chase extension of the Electric Traction Company has progressed very rapidly, and only about 30 days of fine weather, it is stated, will be required to complete it. As this branch is to be operated with current from the main power station, at Delaware Avenue and Laurel Street, there will be no delay.

OTTAWA, ONT.—The first truck with electric motors for locomotive work to be used in Canada was shipped from here to Oshawa, Ont., this week by Ahearn & Soper. It is a specially constructed truck of heavy steel and weighs with motors over eight tons. The motors combined have a capacity of 120 hp The truck will be used in hauling freight cars to and from the Grand Trunk Railway at Oshawa.

NIAGARA FALLS, N. Y.—Work on the Gorge railway is progressing rapidly and the road is approaching completion; the double track from the terminus to the Buttery Elevator has been laid, and only about half a mile of track yet remains to be ballasted. A large force of men is now at work putting in iron and heavy wooden guard rails the entire length of the road to insure perfect security against derailment.

OTTAWA.—The annual convention of the Canadian Electrical Association is to be held in this city in September. The officers of the association are: President, J. K. Dunston, Toronto; vice-president, C. B. Powell, Ottawa; secretary-treasurer, C. H. Mortimer, Toronto; committee, L. B. McFarlane, D. A. Starr, Montreal; F. R. Roseborough, J. J. Wright, J. A. Kammerer, Toronto; C. B. Breithaupt, Berlin, Ont.; John Yule, Guelph; J. W. Taylor, Peterbow; O. Higman, Ottawa.

NEW ORLEANS, LA.—Maas & Gerdes have been granted a franchise for an electric road from East End, in the parish of Jefferson, to Cecil Street. thence to Carrolton Avenue. Capt. Thomas Pickles, of the Algiers & Gretna Railway, has been granted a franchise for an electric road from the lower line of McDonoghville to Company Canal, above Amesville. The Algiers & Gretna Railway at present operates a single track, horse-power car from Algiers to Gretna, and operates a double track to Harvey's Canal. The New Orleans & Carrollton Railway has asked for a franchise to operate an electric road in the parish of Jefferson.

PHILADELPHIA, PA.—The Delaware County Passenger Railway Company is still prevented from using its electric cars on the Westchester Turnpike line by reason of the refusal of a single property owner on the line to give his consent, thereby making it impossible to obtain the unanimous consent which seems to be necessary. The company hopes to get the trolley cars running eventually, and is going ahead with such electrical work as it can do. The car barn is completed, and the new trolley cars are stored away in it. In about 30 days the work of installing the generators and engines at the power station will probably be completed.

TRADE NOTES

H. J. GILLE, who has for a number of years been identified with General Electric interests, has resigned to accept a position with the Washburn & Moen Manufacturing Company, with headquarters at St. Paul. He will enter upon his new line of work about Aug. 15.

THE FUEL ECONOMIZER COMPANY, of Matteawan, N. Y., reports that business is improving and the factory is now very busy, among some of the large orders recently closed being the following: Anaconda Mining Company, Anaconda, Mont., 2,400 hp; Edison Electric Illuminating Company, Paterson, N. J., 2,000 hp; Albany Electric Illuminating Company, Albany, N. Y., 600 hp; Toledo Traction Company, Toledo, Ohio, 2,000 hp; West End Street Railway Company, Boston, Mass., 2,000 hp.

"IN A NUTSHELL" is the title of a little pamphlet issued by Hine & Robertson Company, of 57 Cortlandt Street, New York, explaining fully all the facts connected with the use and operation of the Planimeter, used in conjunction with indicator cards. In a conversation with them the surprising fact developed that but few electric light or street railway plants have an indicator. When managers come to realize that only by the use of the indicator can they keep a check on their engines we feel confident that a greater number of them will be used.

BRANCH OFFICES have been established by H. E. Collins & Co., of Pittsburg, Pa., sole sales agents for the Cahall vertical water-tube boiler, at No. 24 South Water Street, Cincinnati, Ohio, in charge of Mr. John R. Bitner; at No. 71 Perin Building, Cleveland, Ohio, in charge of Alex. H. Lewis, and at No. 712 Union Street, New Orleans, La., in charge of Lewis Metesser. The representatives chosen have all been long connected with the boiler business in different fields and are all capable, earnest and energetic men, and give great promise of extending the sales of the Cahall boilers even beyond the original expectations of either the manufacturers or the original promoters.

SNOW PLOWS are not required extensively just at this season of the year, but later on, before the problem of keeping street railway tracks open assumes formidable proportions, it might be of interest to glance through the catalogue of Wendell & McDuffie, 26 Cortlandt Street, New York, sales agents for the snow plows of the Taunton Locomotive Manufacturing Works. The catalogue contains descriptions and excellent illustrations of both heavy and medium weight plows for single and double-track service, one of the salient features of all of which is an arrangement enabling the motorman to drop the "diggers" into place by a kick of the foot, or lift them by a single movement of a quick acting lever. These plows were put on the market last Fall, and it is stated that twelve of them were sold before any of them had been practically tested, so obvious was the mechanical excellence of the apparatus.

SIX THOUSAND HORSE-POWER in Ide and Ideal engines are reported by W. R. Fleming & Co., representing the Harrisburg Foundry & Machine Works, of Harrisburg, Pa., as having been sold during the past three months through their offices in New York, Boston and Philadelphia, exclusive of sales made outside their territory. The list is as follows: One 160-hp, direct-connected to Siemens & Halske, dynamo for Hotel San Remo, New York; one 150-hp, direct-connected to General Electric dynamo for New York Life Insurance Company, New York; three 150-hp, direct-connected to Crocker-Wheeler dynamos for Hotel Walton, Philadelphia; two 50-hp, direct-connected to General Electric dynamos for Fahys' Building, New York; one 150-hp tandem compound engine to the S. O. & C. Company, Ansonia, Conn.; one 80-hp and one 120-hp, direct-connected to General Electric dynamos for Germania Life Insurance Company, New York; two 30-hp, direct-connected to General Electric dynamos for Hotel Stenton, Philadelphia, Pa.; one 40-hp and one 60-hp for W. H. Hayden, Bath, Me.; one 25-hp to Brigham Electric Company, Boston; two 400-hp direct-connected to General Electric railway generators for export to Rio Janeiro; one 30-hp for Columbia Spinning Company, New Bedford, Mass.; one 20-hp for new city hall, Brockton, Mass; one 300-hp tandem-compound Ide engine for export to South Africa; one 75-hp Ide for American Surety Building, New York; two 750-hp tandem-compound railway engines (Ide) direct-connected to General Electric dynamos for Philadelphia, Castle Rock & Westchester Railway Company, Philadelphia, Pa.; two 80-hp direct-connected General Electric dynamos to Bar Association Building, New York; two 50-hp direct-connected to dynamos for the Lorsch Building, New York; three 125-hp direct-connected to dynamos and three 125-hp Harrisburg boilers, with complete steam construction, for U. S. Custom House, New York; two 200-hp tandem compound engines and one 40-hp simple for magnificent new Hotel Royal (Poinciana, Fla.); one 100-hp engine for Larchmont Electric Company, Mamaroneck, New York; one 60-hp for Mail and Express Building, New York; one 25-hp engine and one 25-hp boiler General Electric Company, Foreign Department, Schenectady; one 15-hp, Manhattan Railway Company, New York; three 125-hp direct-connected to Siemens & Halske dynamos for apartment house, Seventy-fifth Street and Columbus Avenue, New York; three 50-hp direct-connected to Eickmeyer dynamos for elevator service in Fahys' Building, New York.

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED AUG. 6, 1895.

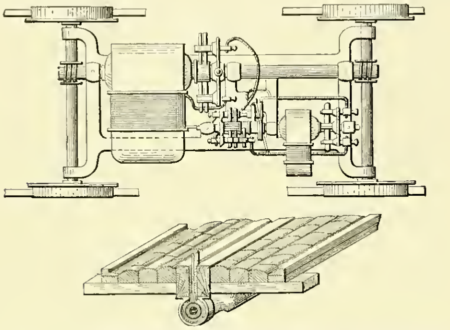
543,837. STREET CAR BRIDGE FOR BRIDGING OVER FIRE HOSE; William H. Baker, Detroit, Mich. Filed May 17, 1895. Two end sections are hinged to the end of the central wheeled section of the hose bridge and are adapted to fold over upon the same. They are tapered downward toward their outer ends, the adjacent ends of the section being recessed to embrace the lines of hose.

543,849. CAR FENDER; Rufus O. Clark, Marlborough, Mass. Filed April 15, 1893. The fender has a horizontally inclined sliding frame supported from the platform, a push spring being provided for projecting the frame. A mechanism is employed for housing the frame against the force of the spring and a device is used for locking the frame when housed.

543,867. CONSTRUCTION AND OPERATION OF ELECTRIC RAILWAYS AND TRAMWAYS; Isaac W. Heysinger, Philadelphia, Pa. Filed April

11, 1892. There is a continuous line of heat pipes contiguous to the track rails but separate therefrom and parallel therewith and adapted to communicate the heat thereto. A heat retarding covering is adapted to permit a slow and gradual emission of heat to the rails and waterproof protection, means being provided for forcing a current of heated fluid through the pipes.

543,924. CAR FENDER; James B. Campbell, Pittsburg, Pa. Filed April 18, 1895. Yokes are connected to the fender proper and a support is provided for carrying them. Rearwardly and upwardly extending bent bars have their lower ends pivoted to the yokes and latches carried by the bars engage projections on the fender. A bell crank lever is connected to the upwardly extending bars and a dog pawl is carried by the lever and engages a rack. A treadle pivoted upon the upper end of the lever has a spring-pressed connection with the pawl.



No 544,037.—CONVERTER SYSTEM FOR ELECTRIC RAILWAYS.

543,963. RHEOSTAT CONTROLLER; Clyde Landers, Tacoma, Wash. Filed March 27, 1894. An upright board has a series of plates at its upper end and a series of buttons at its lower end, both plates and buttons being connected respectively by wires, the latter being in circuit with a resistance coil. A series of reversing switches or segments beneath the plates is electrically connected with the series of buttons on the lower side of the board, the buttons and the motors being electrically connected. Connections are made between the trolley wire and one of the reversing switches or segments and with the rail. An operating lever is pivoted in the board and carries a series of contact points thereon.

543,972. CAR FENDER; Cornelius Sullivan, Newark, N. J. Filed Dec. 17, 1894. This is an electrically controlled fender with electrical appliances under the control of the motorman for operating it.

544,037. CONVERTER SYSTEM FOR ELECTRIC RAILWAYS; Thomas Harper, New Brunswick, N. J. Filed June 29, 1894. A series of transformers, the coils of which are in circuit with the generator, is arranged at intervals along the railway and has closed magnetic circuits in the form of slotted conduit sections. There is a movable, flexible, secondary coil in the conduit, the axis of the coil being parallel with the axis of the conduit. A vehicle carries the secondary coil and a motor in the vehicle is in circuit with the coil. (See Illustration.)

544,051. GRADING AND EXCAVATING DEVIÇE; Thomas B. Redmond, Chattanooga, Tenn., and Solon Z. Ruff, Atlanta, Ga. Filed Dec. 18, 1894. A dirigible electric locomotive is used carrying a trolley. There is a laterally movable conducting wire receiving its current from the source of electricity and a plurality of transverse supporting wires are stretched above the conducting wire. A frame is provided with an upward grooved roller and lower guide rollers, both being made of insulating material, and being adapted to receive the tranverse wire and travel thereon and supporting the conducting wire.

544,056. CONDUIT SYSTEM FOR ELECTRIC RAILWAYS; James Thomas and William B. Thomas, Catasauqua, Pa. Filed Dec. 6, 1894. Insulating brackets support positive and negative conductors in the conduit and trolley wheels are adapted to engage with these conductors. The trolley bar is composed of two grooved plates bolted together, and insulated guide plates are provided with right angular flanges and bolt passages, being located on each side of the bars. There are insulating sleeves in the bolt passages and securing bolts pass through the sleeves, with insulating washers between the heads and securing nuts of the bolts and guides. Slides mounted between the guide plates have base flanges adapted to pass under the right angular flanges and thus guide the slides in their vertical movements. Bow springs actuate the slides, each spring having one end attached to the trolley bar and the opposite end secured to its respective slide, so that the slide is normally depressed and can rise only under spring pressure. Segmental bars are pivoted near their centres to the slides, respectively, and are adapted to support the trolley wheels upon their ends, permitting a vertical movement of the wheels irrespective of the slides. Conductors electrically connect the slides with the car above and extend through the grooves in the trolley bar, but pass out of the same a proper distance from the tops of the slides to which they are respectively secured.

544,081. CAR FARE REGISTER; Stephen M. Balzer, New York, N. Y., assignor of one half to William H. Humphrey, Norfolk, Conn. Filed Aug. 14, 1894. The register has a longitudinally movable shaft, with a pawl carried thereby. A registering wheel is mounted on the shaft, and a toothed projection is connected with the wheel for engagement with the pawl, so that when the shaft is moved longitudinally the pawl can be brought into engagement with the tooth on the wheel.

544,099. RAILWAY RAIL JOINT; Daniel N. Hurlburt, New York, N. Y. Filed Oct. 16, 1894. A pair of overlapping railway rails has mortises in the overlapping ends in combination with a key fitting into the mortises, the mortises being so cut that the key in fitting them will extend at each end into the solid web and entirely across the same.

544,139. CAR FENDER; Charles M. Vandegrift, Philadelphia, Pa. Filed April 19, 1895. The fender consists of a netting, levers and bars, latches and eyes common thereto, with a buffer attached to yielding devices mounted in the levers. Means are provided for raising the fender and unhooking the latches in unison and for sustaining the fender in its normal position.

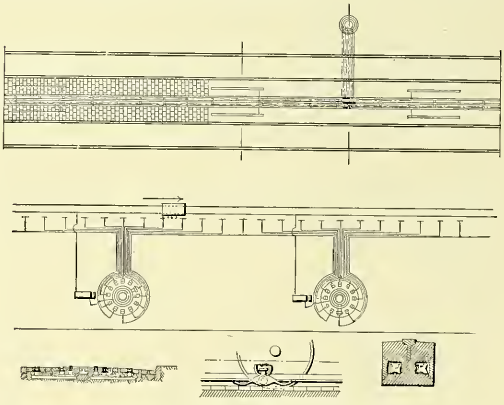
544,157. TROLLEY WHEEL; Jesse Conway, Baltimore, Md., assignor of five eighths to James F. Morrison, same place. Filed Jan. 4, 1895. The wheel has a central annular groove and two side flanges, one on each side of the central groove, and has on its inner side a continuous spiral groove adapted to direct the line-wire from the flange to the central groove.

544,161. DEVICE FOR REPLACING DERAILED RAILWAY CARS; Patrick H. Durack, Pecos, Texas. Filed April 5, 1895. The car replacer comprises a plate whose side margins converge and whose upper surface inclines upwardly from its rear to its front end, a tongue or lever being pivoted near its front end upon and near the front end of the plate. A pin engages an aperture in the tongue or lever near its rear end and is adapted to engage one or another of a series of apertures in the plate. Downwardly disposed hook arms are secured to opposite sides of the plate, one of them engaging a track rail when in operative position. An adjustable bolt is carried at one end of the plate and engages the under side of the head of the rail.

544,195. CAR FENDER AND WHEEL GUARD; George E. Shoemaker, Philadelphia, Pa. Filed Feb. 11, 1895. This is a collapsing wedge-shaped fender, and consists of a number of sections pivoted at their inner ends and having their outer ends normally elevated, but adapted to be released by the foot or automatically by the blow of a collision, a yielding buffer being located in advance of the dash. A spring-seated frame beneath the platform connects the fender and buffer.

544,198. ELECTRIC RAILWAY; Francis Taylor, Charlotte, N. C., assignor of one half to Irvin W. Durham, same place. Filed Nov. 30, 1894. This is a conduit railway, the conduit having the live wire at one side of the slot. A vertically movable frame is suspended from the car frame and has plow members projected at the front and rear ends of the conduit slot and a shank member or transmitter rotates in the frame. A brush which is secured to the lower end of the shank is projected at an angle therefrom, so that it engages the live wire.

544,209. ELECTRIC RAILWAY AND TRAMWAY; Jean Claret, Lyons, and Olivier Wuilleumier, Clermont-Ferrand, France. Filed July 25, 1893. Patented in France Nov. 3, 1892. This patent covers an electric railway system which has been installed in Lyons, France. There is a series of spaced contact surfaces with a main conductor supplying current to them in succession. An automatic distributor has terminals connected to the surfaces, means being provided for automatically bringing the contact surfaces successively into electrical connection with the main conductor one at a time and locking the connection until the succeeding contact surface is reached by the car. (See Illustration.)



No. 544 209.—ELECTRIC RAILWAY SYSTEM.

544,240. HOSE BRIDGE; John P. Terry, Baltimore, Md., assignor to Edward D. Booz, same place. Filed Feb. 8, 1894. The hose bridge is so constructed that it fits the top of the track rail, a clamp consisting of a hooked bar having a vertical slot. A bolt passes horizontally into the bridge through the slot and a set screw for tightening it passes down through the upper end of the bar and bears against the bolt.

544,244. STREET CAR FENDER OR GUARD; Casper S. Yost, George W. Baumhoff, August H. Hagemeier, Frank Fitzler and Otto Schmid, St. Louis, Mo., assignors of one sixth to James Adkins, same place. Filed Jan. 5, 1895. Outer links connect the platform to the car body and inner links are pivoted to the platform at their lower ends. The inner links are secured at their upper ends to a rock shaft and a lever which is connected at its lower end to the car body is secured to the rock shaft. An operating shaft is provided with a chain connecting a crank on it to the lever. A stop pin secured to the shaft works in a slot in one of the boxes of the shaft and a handle on the upper end of the shaft moves the fender in opposition to the spring.

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Vol. XIII. NEW YORK, AUGUST 24, 1895. No. 8.

Nassau Electric Railway of Brooklyn, N. Y.

The system of the Nassau Electric Railway Company in Brooklyn has now been operated for four weeks, and the company is doing a heavy business. The company has met with many legal difficulties, and was delayed for a considerable time by injunctions from opening its lines even after everything was in complete readiness for traffic. At the present time it is to be considered the victor in the litigation, although questions in dispute have not yet been passed upon by the court of last resort. The moment that the writ restraining the company from operation was vacated by a court of appeal, the officers set to work to put its cars on the rails, and within 36 hours passengers were carried over the system.

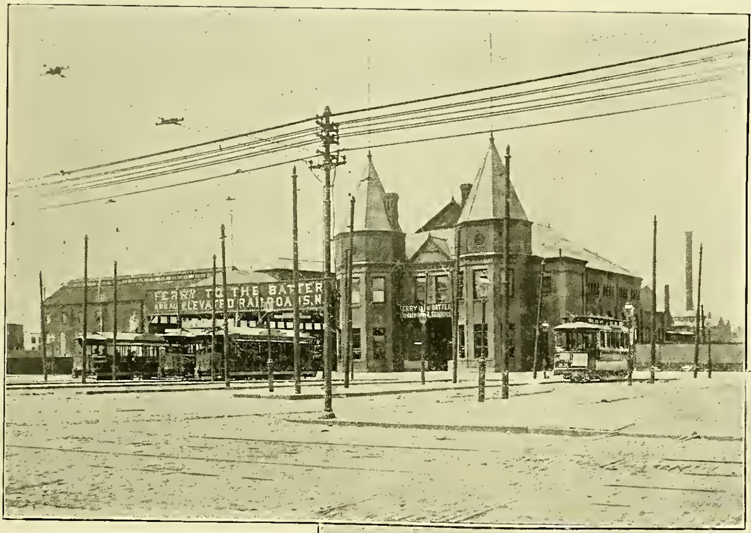


FIG 1.—TERMINUS OF THE ROAD AT THIRTY-NINTH ST. FERRY.

The Nassau Company has constructed at the present time 37 miles of road. The route is as follows: Commencing at the Thirty-ninth Street Ferry it extends to Thirteenth Avenue, to Thirty-seventh Street, to Church Avenue, under the Ocean Parkway, to Rogers Avenue, to Bergen Street, to Nostrand Avenue, to Fulton Street, to Marcy Avenue, to Broadway, to Hamburg Avenue, to Cooper Street, to South Eighth Street, to Broadway and to the ferry at the foot of that street, thence to Marcy Avenue to South Fifth Street, to Union Avenue, to Morgan Street, to Rockaway Avenue, to Rockaway Parkway, to Canarsie. The extensive district in Brooklyn covered by the system has already shown its appreciation of the new transportation facilities. On a recent Sunday the receipts, it is stated, aggregated $2,900.

Many features of interest in connection with the system have already been described in the GAZETTE, and illustrations of additional points of interest are presented herewith. The new car house, which is shown in Fig. 4, is located at Thirty-seventh Street and Church Avenue in an extremely sparsely settled district of the city. The structure is of brick with steel columns, the roofs being supported by steel trusses furnished by the Variety Iron Works of Cleveland. The building, of which the dimensions are 168 by 157 feet, is built with four bays, each with four tracks. The 16 tracks have a storage capacity sufficient for 80 cars.

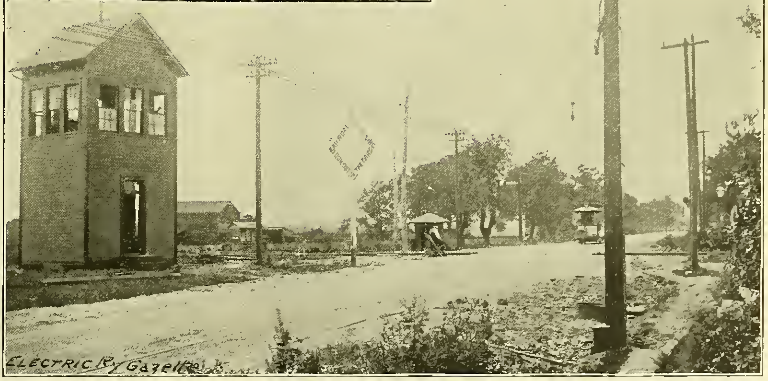


FIG. 2.—STEAM ROAD CROSSING SHOWING SIGNALS.

The building shown in Fig. 3 is located at the same point. It contains waiting rooms for passengers and rooms for the conductors and motormen. It is built of brick on a triangular plot of ground and adjoins the car house. The waiting rooms are comfortably furnished and are provided with all conveniences for passengers and for the men. The company will build in the near future a repair shop with dimensions of 200 by 240 feet in the rear of the car house.

The building will contain machine, paint and woodworking departments, and an armature winding-room. The several departments will be equipped with the best machine tools and appliances, so that repairs can be made in the shortest possible time. On the Canarsie division a second car house will be built which will occupy a space 200 by 250 feet. It will be constructed of brick and similar to that shown in Fig. 4.

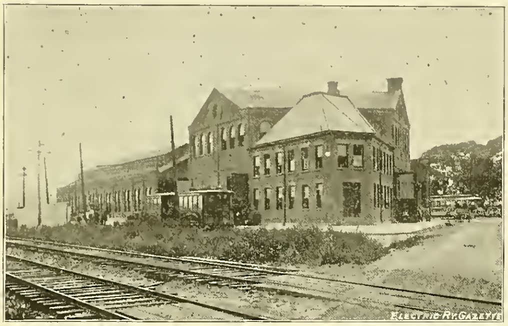


FIG. 3.—STATION AT CHURCH AVE. AND THIRTY-SEVENTH ST.

It was not possible to cross at grade the Ocean Parkway, the popular route to Coney Island, with its famous cycle path, also leading to that resort. The company has therefore built a tunnel at the point which is illustrated in Fig. 7. Its total length, including the approaches, is about 600 feet. The grade on the approaches each of which is 184 feet in length, is 6 per cent., and the central portion is level. The tunnel has 14 feet 6 inches headroom, and is 18 feet in width in the clear. The sides and approaches are constructed of blue stone and the walls of the latter are surmounted by a wrought-iron railing. The trolley wires are carried through the tunnel on wooden troughs attached to the roof. The roadway over the tunnel forming part of the Parkway is supported by 15-inch steel I beams with spring arches on which the concrete of road is laid. The cycle path is supported with 12-inch I beams and iron plates.

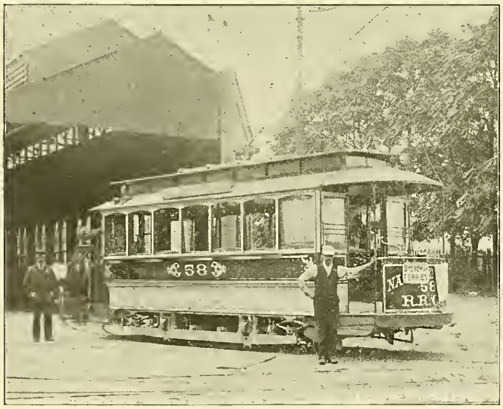


FIG. 5.—CLOSED CAR.

The company has provided at all points where the line crosses a steam road derailing switches and signals which interlock with the steam railway signals so that the possibility of a collision is reduced to a minimum. The arrangement is shown in Fig. 2.

The closed cars, Fig. 5, which the company is operating on its line were built by the John Stephenson Company of New York. They are mounted on Dupont trucks made by the Johnson Company, and equipped with motors furnished by the Steel Motor Company of Cleveland. The bodies are finished in dark blue and cream colors, and are lettered and ornamented in silver. They carry electric headlights which are mounted on the bonnets. The open cars operated on the Canarsie line were furnished by the Brill Company of Philadelphia, with the same types of trucks and motors as used on the closed cars.

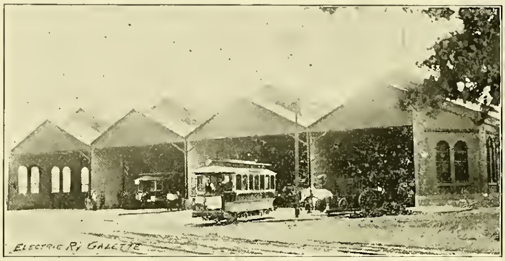


FIG. 4.—CAR HOUSE.

The track construction of the company is very much heavier than that of any other company in Brooklyn. The rails are nine-inch girders of the Johnson Company's manufacture and weigh 93 pounds to the yard. The joints have been electrically welded throughout. So far this method of connecting the rails has given entire satisfaction. The equipment of welding machinery which was used on the line is shown in Fig. 6.

The company proposes to make many important extensions to its present system. Work on the line from Rogers and Church avenues to Manhattan Beach and on the line to East New York will be begun without delay. In all probability a line to West Brighton, Coney Island, will be constructed next Spring. This road will pass through Fort Hamilton, Bath Beach and Bensonhurst.

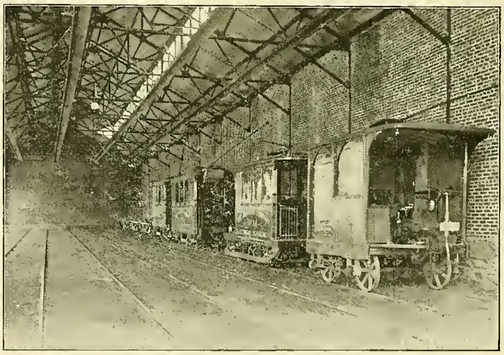


FIG. 6.—RAIL WELDING MACHINES IN CAR HOUSE.

The power station of the company is located on a jetty in New York Bay at the foot of Thirty-ninth Street. Its dimensions are 150 by 106 feet and the building is of the standard construction of the Berlin Iron Bridge Company, of East Berlin, Conn. Ample light and ventilation are provided by numerous large windows on all sides of the structure; in addition windows are built in the monitor roof extending the entire length of the building.

The power plant will soon be increased to a capacity of 3,000 hp. At present the power equipment consists of three cross-compound condensing Cooper-Corliss engines of 750 hp, each directly connected to Westinghouse multipolar generator. The engines were especially designed by C. & G. Cooper & Co., of Mount Vernon, O., for street railway work. The cylinder dimensions are 22 and 40 inches in diameter with 48-inch stroke, and the engines will be run at a speed of 90 revolutions per minute.

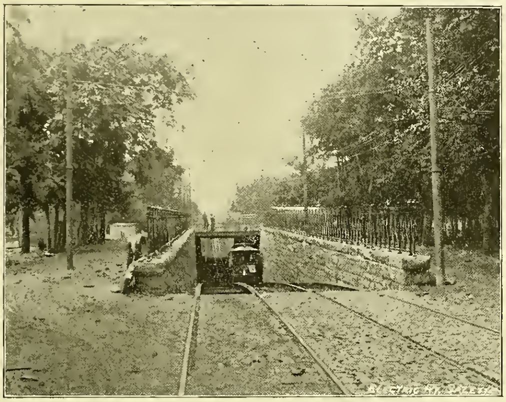


FIG. 7.—TUNNEL UNDER OCEAN PARKWAY.

The switchboard is of the standard Westinghouse type, with white marble panels and Westinghouse and Weston instruments. The engine room is equipped with a 34-ton traveling crane, with a span of 53 feet and 6 inches, built by the Berlin Iron Bridge Company.

Brooklyn Heights Road and Its Former Employees.

It was noted in the last issue of the ELECTRIC RAILWAY GAZETTE that the Brooklyn Heights Railway Company had signed a formal agreement with the Labor Union, in accordance with which its former employees who left their positions on a strike last Winter should be given preference when they made application for work. In consideration of the agreement, the Union agreed to remove the boycott against the company. The fact that the company treated with the labor organization which it expended half a million dollars to defeat in the great strike occasioned considerable surprise. It was explained, however, that the company wished as far as possible to remove the bitterness growing out of the labor troubles, and for this reason was willing to agree to place on record its readiness to conciliate its old employees. This view was accepted as correct until Thursday last, when the secretary of the District Assembly addressed a circular to the public and labor organizations of Brooklyn and vicinity, giving his version of the agreement with the company. This document was as follows:

"The Brooklyn Heights Railway Company has made an amicable, just and satisfactory settlement with their old employees who left the service in consequence of the late strike. President Rossiter has agreed to give them the preference over all other applicants for employment, as vacancies may occur, and to re-employ them in batches of 50 at a time as fast as possible; has agreed not to discriminate against them for being ex-strikers, nor for belonging to the Knights of Labor, before or after entering his service; he has consented to receive committees from the union men on his roads concerning grievances, should any exist, and he has promised to make $1.65 per day the minimum wages, thus practically settling the tripper question, which was the sole cause of the late strike. The public of Brooklyn will not be slow to appreciate Mr. Rossiter's generosity to the old conductors and motormen, who are all citizens of the city, by patronizing his roads whenever possible and thus again restore to the Brooklyn Heights Railway Company the patronage and revenue which the short-sighted policy of his predecessor lost.

"The officers of D. A. 75 are deeply impressed with President Rossiter's sincerity and have perfect confidence in his honesty and good faith. In consequence of the above concessions D. A. 75 agreed to do its utmost to raise the boycott which was ordered against the Brooklyn Heights Railway Company and willingly takes this opportunity of informing the public of the fact. D. A. 75 also requests all kindred organizations to inform their members that all questions at issue between the Brooklyn Heights Company and their old employees have been satisfactorily adjusted and that the embargo against their lines has been lifted."

When President Rossiter, of the Heights Company, was asked whether the agreement was so great a concession to the old men, he replied emphatically in the negative. He said the agreement was expressive merely of the company's favorable attitude toward the men. "We have not," he said, "agreed to such terms. It is absurd to say that we would take the old men back in batches of 50. We shall take back such men as we want when we want them, giving the old men the preference. We have not made any arrangement by which we will hear the grievances of the union men through their committees and we have not agreed that no wages less than $1.65 a day shall be paid."

Use of Fenders Made Compulsory in Massachusetts.

The Massachusetts Board of Railway Commissioners has promulgated the following order requiring street railway companies to equip their cars with fenders:

"1. All cars run by a street railway company on a highway, town way or traveled place (excepting cars run by horse power, cars run only as trailing cars, and, until the further order of the board, cars run wholly within the limits of towns whose population is less than 7,500 each), shall be equipped with fenders and wheel guards in accordance with one of the two following methods: Either (1) with a fender at the front of the car (going in either direction), and also with wheel guards underneath the car; or (2) with a fender at the front of the car of such design as to serve also as a wheel guard.

"In the first case (1) the fender shall consist of a platform, netting, or other similar device, constructed and arranged so as with reasonable certainty to pick up a person who is run into while standing, but to pass over a person who is lying on the ground, without probable injury to the person in either contingency; and the wheel guards shall be of such construction and arrangement or method of operation as to prevent, so far as practicable, a person who has fallen or been thrown down from being run over by the wheels.

"In the second case (2) the fender shall be of such construction, arrangement and method of operation as not only to pick up as aforesaid a person who is run into while standing, but also to prevent, as far as practicable, a person who has fallen or been thrown down from getting under the car and being run over by the wheels. This form of fender shall accordingly include a device by which, in case of emergency, it can be lowered by the motorman, and when lowered held down close to the ground.

"2. These regulations shall take effect on the 14th day of November, 1895, and may be modified from time to time, in general or in particular, as experience and the public safety may seem to the board to require.

"There are, it is well known, many kinds of forms of fenders and wheel guards. It can, perhaps, hardly be expected that any of them will afford absolute protection under all circumstances. Some of them have shown or promise reasonably good results, but no one fender or wheel guard has as yet been proved to be so unquestionably superior to all others, tried and untried, as to justify the prescription of its sole and exclusive use.

"Under these circumstances it has seemed to the board, in the performance of the extremely perplexing task imposed upon it by the statute above cited, to be wiser and better to define the methods of protection, and point out the essential features or requisites of the appliances which must be adopted than to prescribe the use of any particular invention or device. There are obvious reasons why the companies should not be compelled to deal with a single patentee. It is, moreover, desirable that different types, within the lines prescribed, be tested by actual use. Only in this way will the best device be found out.

"It is expected, therefore, that the several street railway companies, in the exercise of a careful judgment, in good faith toward the public, and upon their own legal responsibility under the statute, will select and apply to their cars such fenders and wheel guards as come within and satisfy the requirements of the above regulations."

Storage Battery Cars for New York.

The New York & Harlem Railway has determined to make another attempt within the next 90 days to run storage battery cars on the Fourth & Madison Avenues line. Six years ago storage battery cars were run on the line, but owing to patent litigation the use of the cars was enjoined.

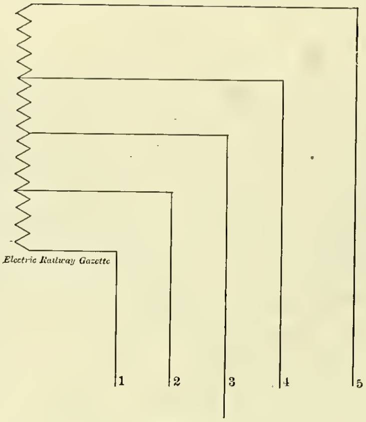
Another Pennsylvania Railway Trolley Line.

It is announced that the Pennsylvania Railway Company will electrically equip its line between Mt. Holly and Medford.

Practical Notes for Motormen.—XII.

BY GEORGE T. HANCHETT.

If we should adopt the controller shown in Fig. 42 we would find that, besides the danger and inconvenience of having but two grades of speed, the motors and controller would suffer seriously. It is necessary to have intermediate notches, and in order to have these work at intermediate speeds they must throw resistances into the motor circuit. It is desirable to have the same resistance do duty for the notches while the motors are in series and also while in parallel. Hence we must take account of these in connecting up our controller. It should not be difficult to have sets of contacts to pass under the fingers which would throw resistance into the motor circuit progressively cut out by combination of contacts as the controller proceeds.

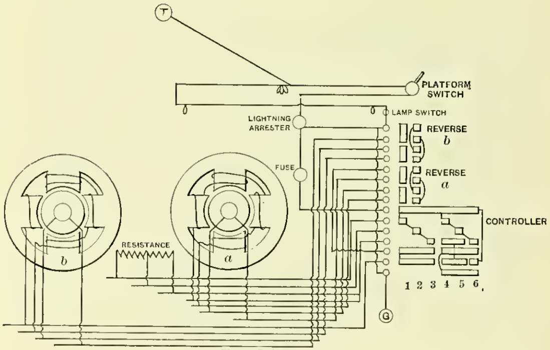


Electric Railway Gazette

FIG. 43

One of the most common devices is as follows:

A number of resistances are connected in series with one another, and wires are led out from the places where they join. See Fig. 43.



Electric Railway Gazette

FIG. 44.

Suppose the trolley current directly applied to 1. On the first notch of the controller it is taken off and fed to the motors from 5; on the second notch from 4; on the third notch from 3, etc., till on the last notch the motor gets full trolley voltage.

Fig. 44 shows how the device may be applied to the controller. Various manufacturers vary in the mechanical methods of making these connections and many of these cannot be well shown diagrammatically. In the diagram, as in the previous ones, no attempt is made to show the mechanical devices. A simple cylinder with plates upon it is all that is used. This controller has six different speeds. It should not be difficult to comprehend. There is a long trolley plate at the top and a long ground plate at the bottom of the controller. The current enters at the top and works downward.

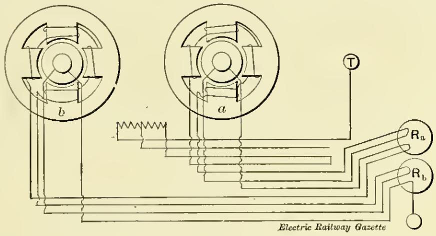


FIG. 45.

For purposes of illustrating the principles six accompanying sketches are presented, Figs. 45 to 50 one for each notch of the controller. Such parts as would tend to confuse are omitted in each sketch. The reversing switch is shown in one position only.

From these sketches the student can gain an idea of what the controller does. How the mechanism makes the contacts is a matter to be learned from the particular controller studied and usually an actual examination of the controller is necessary. The writer has shown one way of accomplishing the result, but there are others.

The most frequent occasions when the motorman has to call upon his store of electrical knowledge occur on the road. Ordinarily the difficulties are few in number, but the causes thereof are many and various.

Most motormen are satisfied if the motors operate at the command of the controller and care very little whether they spark or heat. Some are more careful, and toward the end of a trip lift the trap doors and inspect the machine.

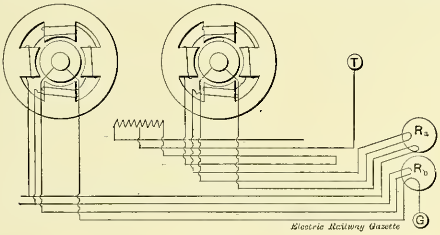


FIG. 46.

The following difficulties are liable to occur on a railway equipment:

1. The car refuses to move with the controller full on.
2. The car persists in moving with the controller full off.
3. The motors get abnormally hot in parts; *e. g.*, a field coil, commutator, or bearing.
4. The brushes spark badly.
5. The fuse blows continually.
6. The insulation of one or both of the motors breaks down, often causing serious arcing at the affected points.
7. The motors start with a rush on the first notch, instead of gradually.
8. The car refuses to start till the middle notch is reached.
9. The car does not increase its speed after the middle notch is reached, but the speed at first is faster than usual.

The causes that may produce these difficulties are so numerous that they will largely cover the ground of all trouble that is likely to occur.

If any of these troubles occur do not jump at a conclusion and apply a remedy. True, the car may be running on short time, but more money will be saved for the employer by considering the matter a little, and arriving at a sober second thought conclusion. Let us take up these difficulties in their order.

1st. *Failure of the car to start.* This may be because the motor has no current or because it has become disabled and cannot use current if it had it.

The first of these causes is the more probable. The circuits of a railway equipment may be opened in many places, some of which are the following:

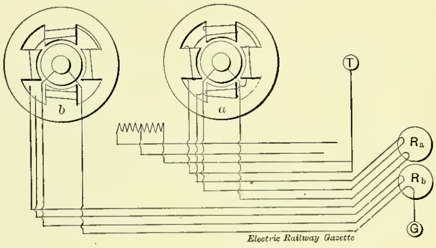


FIG. 47.

1. The trolley—may be off.
2. The overhead platform switch—may be open.
3. Sometimes the rear overhead platform switch is in series with the front one and—may be open.
4. The controller may have its trolley terminal disconnected or broken, or its contact may fail to work properly.
5. The fuse may be blown.
6. The brush or brushes may have jarred loose and fallen out or may be broken.
7. A connection on the motor or under the car may have jarred loose.
8. There may be a broken or burned wire in the car wiring, or the motor itself.
9. The *ground* may be poor.

Causes 1 to 7 require mere inspection. Cause 8 should only be assumed after all other remedies have been applied. Cause 9 is really the only one that may be puzzling. The motorman or conductor usually knows enough to turn on the lamp circuit to see if the power is forthcoming at the station. If such is the case the

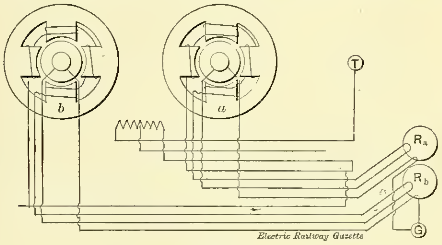


FIG. 48.

lamps will almost invariably light up. However, it is well to be sure the lamp circuit is in order before assuming the indications to be proof positive that the trolley wire is dead. Often the lamps will light up and still the motor will fail to start when everything is in apparent good order. If such is the case attach a wire to the car truck and carry it forward to the rail in front, or to the rear rail, and make a good firm contact between the rail and the wire. On throwing on the controller the difficulty will usually disappear.

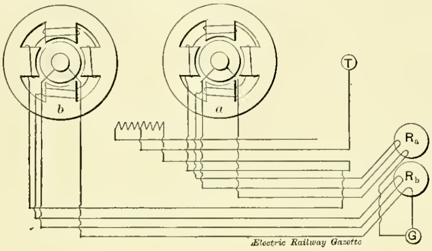


FIG. 49.

It frequently takes 10 or 15 hp to start a motor car, and a ground while amply able to carry half an ampere for lights may easily fail to carry 20 or more amperes for the necessary power. This accident is very liable to happen where flat rails on wooden beams are used. These rails are frequently unbonded or the bonds have broken loose. Hence, when a motor gets upon such a rail and stops it is frequently stalled.

2d. *The car persists in moving with the controller full off.* This usually occurs while the car is in motion and an attempt to stop is made. When it is discovered that the car is no longer under control, open the overhead switch and bring the car up with the break. This difficulty usually has its cause in the controller itself. Remove the cover from the controller and throw on the overhead switch. The defective portion will usually indicate its whereabouts by a smoke. Thus the cause may be detected and removed. Sometimes the trouble lies in two or more crossed wires in contact under the car. This may be detected as indicated in the case of the controller.

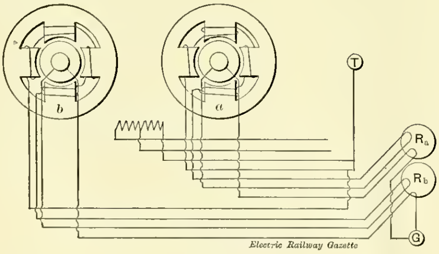


FIG. 50.

In this difficulty current is finding a path through the motors when it should not do so. It is therefore bridging some insulation, and the chances are smoking and destroying it.

3d. *The motors get hot in parts.* There are several parts to a railway motor that are liable to heat and for different reasons. The bearings may heat for lack of oil, or for no lack of sand or grit. They may be out of line or the shaft may be sprung.

The last two causes are not usual, and for them there is no ready remedy. The first two are common causes, and should be remedied by profuse lubrication.

The commutator may heat because of its proximity to a hot bearing, but is more liable to heat because of sparking of the brushes. This cause requires a whole section to treat of, and will be discussed later. Sometimes the heat is due to needlessly heavy pressure of the brushes on the commutator. Examine the motor in motion, and if it be sparkless, relieve the brush pressure. If there are sparks, remove them according to the facts set down in the next section.

(*To be continued.*)

Liverpool Overhead Electric Railway.

The semi-annual report of the board of directors of the Liverpool overhead electric railway contains the following figures: The gross revenue receipts for six months, ending June 30, aggregate £28,143 3s. 1d., and the working expenses to £18,653 18s. 1d. The number of passengers carried since the opening of the railway has been as follows: Half-year ending December 31, 1893, 2,475,639; half-year ending June 30, 1894, 2,861,437; half-year ending December 31, 1894, 3,641,379; half-year ending June 30, 1885, 3,460,060. These figures show a continued and satisfactory increase in the traffic. The contracts for the southern extension have been let, and the works will be commenced without delay. In order to meet the necessary expenditure, the directors have decided to offer to the shareholders at par, on application, the unissued portion of the ordinary capital stock. The amount available for dividend is £8,076.

Fender Suits in Philadelphia.

Suits have been brought by the city of Philadelphia against the local street railway companies to recover penalties for their alleged failure to comply with the ordinance of March 27, 1895, requiring that every car in the city should have safety guards or fenders. The suits are test cases, the penalty only being sought to be recovered against one car on one date. Five of the actions are brought against the Philadelphia Traction Company to recover $10 in each case for different cars run on June 26 last. Two of the actions are against the Manayunk & Roxborough Inclined Plane Electric Railway Company, to recover for cars Nos. 1 and 12 run without fenders on the same date. The other suit is against the People's Traction Company to recover the penalty for not having a fender on car No. 129 on June 26 last.

General Electric Company to Remain in Schenectady.

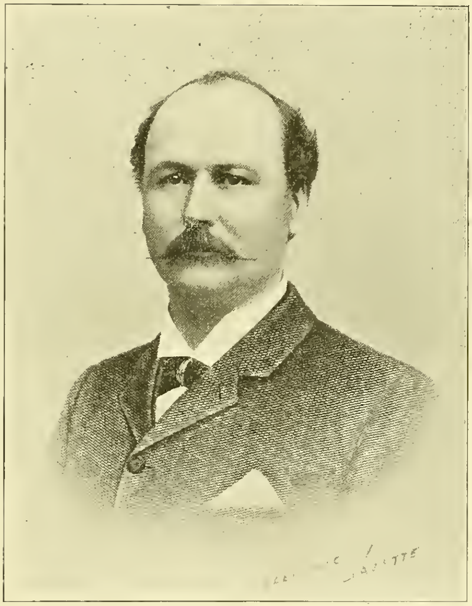
The General Electric factories are not to be removed from Schenectady. The commission appointed to appraise the property abutting on Kruesi Avenue, which street must be closed to give the company additional room required, finished its work on Thursday afternoon and gave fair values for the property, the whole parcel amounting to about $56,000. It is stated that the street will be closed almost immediately and that the General Electric Company will proceed to erect new buildings at a cost of $200,000. It is said that at least 1,000 more hands will be employed by Oct. 1, making 5,000 in all. The Lynn works and the Harrison, N. J., works are to be transferred to Schenectady according to good authority, and ultimately 8,000 hands employed.

Street Railway Engineers.—XVII.

J. CLIFTON ROBINSON.

The street railway engineer whose name at the present time is most prominently identified with electric traction in the United Kingdom is Mr. J. Clifton Robinson. He is managing director of the London United Tramways, the London Imperial Tramways Company, the Dublin Tramways, the Middleboro Tramways, and with other traction enterprises in Great Britain. Mr. Robinson has been associated with tramway interests on the other side since the first road of this kind was constructed in England, by George Francis Train, in 1859, in Birkenhead. This was Mr. Robinson's birthplace, and when the tramway was built he was about twelve years of age. He was employed in some humble capacity on the line with a salary of half a crown weekly. He performed his work with great diligence and was rapidly advanced in the service of the company. At the same time he studied with great persistence and during his connection with the company gained considerable practical engineering knowledge.

His ambition and persistence attracted Train's attention, and in 1866, at the latter's suggestion, he visited America, where he studied the operation of the most important street railways. For the same purpose he returned in 1868, and remained until 1869, when he was offered a position on a railway in Lima, Peru. While proceeding to that city he was taken ill, and was prevented from accepting the position. On his recovery he returned to England, and was employed at once to engage actively in the construction and management of tramways in Liverpool. When the construction work had been completed he was sent to take charge of the building of lines in London, and was subsequently engaged in similar work in Dublin.



J. CLIFTON ROBINSON.

In 1872 he was appointed general manager of the tramways in Cork, which were then being constructed. In 1875 he received the appointment of general manager of the Bristol tramways. None of the lines was opened at the time and it devolved upon him to plan and lay out the entire system. His work met with marked success and the system was developed into one of the best and most extensive in Great Britain. Early in 1883 he was appointed to the responsible position of general manager and secretary of the Edinburgh street tramways. The service at the time was unsatisfactory to the public, and the receipts from operation fell far short of the anticipations of those interested in the property. New methods were introduced and the most marked improvement both in revenue and in service followed. Mr. Robinson had by this time become a believer in the mechanical operation of street railways and when in Edinburgh read a paper on tramways before the Royal Scottish Society of Arts, of which he had been elected a fellow, giving a detailed account of the cable system and presenting arguments in favor of its introduction. Shortly after he was appointed general manager of the Cable Corporation. His first work was to complete the equipment of the London Highgate Hill Cable Tramway, the first cable road in Europe, which was formally opened by the Lord Mayor on May 29, 1884. In the Spring of the following year Mr. Robinson severed his connection with the company, and during the next two years engaged in practice as a tramway expert and consulting engineer. He was frequently called as a witness in street railway matters before both houses of Parliament. In 1887 he returned to the United States, and was engaged to construct and manage the cable railways of Los Angeles, Cal., of which an extensive system had been planned. Twenty-one miles of cable were constructed, three power houses were erected, two bridges across the Los Angeles River were built and other improvements of magnitude were made, necessitating the most unremitting application on the part of the responsible manager, and requiring all his skill as an engineer. On leaving Los Angeles Mr. Robinson made his home in San Francisco, where as president of the California Contract Company he was interested in cable railway construction in different parts of the world. Since his return to Great Britain Mr. Robinson has been constantly engaged in tramway enterprises. He has become as enthusiastic in his advocacy of electric traction as he was formerly pronounced in favor of the cable system.

Two Street Railway Conventions.

The annual convention of the New York State Street Railway Association will be held in Albany, on September 17. It is proposed to make the meeting one of unusual interest, and it is promised that several papers treating of topics of timely interest will be presented.

The annual meeting of the Pennsylvania Street Railway Association will be held at Wilkesbarre, September 4 and 5. An interesting feature of the convention will be the exhibit of street railway apparatus at the Ninth Regiment Armory. The Wilkesbarre & Wyoming Valley Traction Company will provide an excursion over its lines for the visitors.

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COMPULSORY ADOPTION OF FENDERS.

It will be seen from an announcement contained in another column that the Board of Railway Commissioners of Massachusetts has directed the street railway companies of the State, with unimportant exceptions, to equip their cars with fenders and wheel guards. The appliances must conform to a certain standard and the work must be completed by Nov. 14 next. One obvious objection may be made to the regulation: it will probably be an absolute impossibility for the companies to comply with it in the prescribed time. If they are to devote any thought to the formidable undertaking of selecting fenders, which, if intelligently performed, will occupy some little time, the appliances cannot be procured from the manufacturers in the next ten weeks. Some of the latter are not ready in any event to supply large quantities of fenders for immediate delivery. The regulation may be regarded as questionable even without reference to the matter of time. A great many companies believe that the fender problem has not been so definitively solved that they should be required to expend a vast sum of money for an equipment; they feel that if they hastily purchase apparatus of this description at just this time, when so many developments are being made, when new types are patented at the rate of 25 a month, they may be obliged to consign it to the scrap pile within a year or two.

NASSAU COMPANY AND SOME OF ITS CONSTRUCTION

Few companies have encountered greater obstacles in attempting to install an electric railway than the Nassau Company of Brooklyn, N. Y., and it may well be congratulated upon the fact that its lines are now in successful operation. It has had a legal fight on hand of great magnitude, and a few weeks ago its position was anything but enviable. After an expenditure of a vast sum of money for track construction, power plant, rolling stock, buildings and general equipment, its franchise rights were pronounced invalid by the New York Supreme Court, and while it was ready to send cars out on its road it was restrained from so doing by a writ of injunction. No course was open to the company but to appeal, and lose, meanwhile, the interest on the investment. As we noted in a recent issue, the court to which the appeal lay overruled the decision of the lower tribunal, affirmed the validity of the grant from the aldermen giving the company the right to operate, and removed all obstacles in the way of opening the road. It is interesting to note how quickly the enterprising gentleman at the head of the company took advantage of the favorable decision of the court. As soon as the news was received the work necessary to put the road in condition for starting was begun with great vigor and was prosecuted with such success that in 36 hours cars were running on the road. This essential preliminary work was no slight undertaking ; it involved the laying of a considerable amount of special track work as well as the thousand and one matters of detail incident to the opening of an extensive electric railway system. The Nassau Company perhaps may be considered the holder of the record for expedition among railways of its class. The new system comes in competition with some of the existing transportation lines in Brooklyn and some very active rivalry between the different interests would occasion no great surprise. Perhaps the most interesting fact in connection with the entire installation of the company lies in its adoption of electrically welded rail joints throughout its system of railways. The company expects to secure from this construction complete immunity from electrolytic troubles, as well as those due to unevenness of the rail ends. The experiment has been made with the most absolute confidence in the outcome, and the amount represented by the welded joints throughout the system is quite an astonishing sum. If the outcome proves equal to the anticipations of the company, there can be no possible doubt as to the wisdom of the investment. Some little time must elapse before any reliable data is procurable, but it is interesting to note that the welded joints, according to the statement of the chief engineer, have stood most satisfactorily the tests of the unusual variations of temperatures of the last 10 months.

THREE STREET RAILWAY CONVENTIONS.

Within a few days now the convention season will be commenced. Already preparations for the Montreal convention of the American Street Railway Association are well advanced. A large attendance is expected and the hosts of the association hope to make the meeting memorable in many respects. There is no doubt that every enjoyable feature that lavish hospitality can devise will be provided for the entertainment of visitors. The exhibit of electric railway apparatus and appliances will doubtless be a feature of great attractive power, and we are glad to know that manufacturers quite generally are disposed to contribute to its success. The business to come before the association is likely to be of a more than ordinarily interesting description. Questions relating to the advisability of widening the scope of the organization in some particulars, so that greater practical benefit may accrue to the membership, will be discussed. Many topics of timely interest to the practical manager of electric railways will be considered; indeed it is proposed to make the discussions of matters of this kind far more prominent than at previous meetings, and we trust success will attend the effort. The discussions of many of the most admirable and suggestive papers at conventions heretofore have been as a rule lamentably inadequate. We may remark here parenthetically that the latest bit of association news conveys the intelligence that St. Louis will probably make a bid for the convention in 1896. All the St. Louis companies, with a single exception, are, we believe, members of the organization, and if they are unanimous in extending an invitation to the association they are likely to meet with an acceptance. Certainly no mistake would be made in selecting St. Louis as a meeting place, for it has demonstrated its ability to entertain most successfully gatherings of representatives of electrical interests, and all street railway men are electrical representatives in these days. Any further consideration of this matter at this time is, however, premature. Two State conventions—those of the Pennsylvania and New York associations—will be held next week. According to reports especial efforts will be directed this year toward making the gatherings successful. The Pennsylvania organization will make a street railway exhibit one of the features of its meeting, and if it proves as successful as the exhibit of last year the members of the association will scarcely be afraid to draw comparisons with those to be seen at the meetings of the American association. We trust that a hearty, cordial effort will be made to increase the usefulness of all these gatherings. The Fall should be a time when all concerned should be benefited by the information disseminated by the street railway conventions.

Rail Melted by Escaping Current.

A rail on the track of the Walpole & Wrentham line of the New York, New Haven & Hartford Railway on the iron bridge at North Attleboro, Mass., was recently melted by current escaping from the line of an electric railway running under the structure. The bridge is so low that the trolley wire is run up on each side of it and anchored to the girders, the cars running under the bridge by their own momentum. When an electric car reaches the bridge the conductor releases the trolley pole from the wire and holds the pole down until he reaches the opposite side of the bridge, when he again allows the pole to engage the wire. One of these insulators became broken, probably by the trolley pole striking it as it was raised after passing under the bridge, and allowed the electric current to escape to the bridge girder. An arc was probably formed between the truss beam and one of the rails. The steel of the rail melted and fell to the ground below. At one place the base of the rail was reduced to a width of 2⅛ inches.

Protection of Grade Crossings.

Payson Tucker, general manager of the Maine Central Railway Company, recently issued an order requiring watchmen at grade crossings of electric railways to display a red ball or lamp on a signal post before allowing any electric car to go on the crossing. This signal is in addition to the gates and flags, and is hoisted for every car, whether a train is expected or not. Enginemen must approach such crossings with trains under control, ready to stop before reaching the crossing if the red signal is displayed.

Trolley Competition in Connecticut.

The steam railways have sustained greater losses due to the competition of electric lines in Connecticut than elsewhere. The State is especially adapted for short line transportation. Eighteen cities contain not less than 65 per cent. of the population; three counties—New Haven, Hartford and Fairfield—include about 68 per cent. of the total population. The maximum distance from any Connecticut city to the nearest city is 23 miles by rail, while various cities merge into each other.

In a recent number of the *Engineering Magazine*, Clarence Deming discusses at considerable length phases of the competition, and the following extract is taken from his excellent paper:

The obstacles to the trolley in the State have been two-fold: First, that tenacity of property rights so marked in New England communities, and revealed in Connecticut, not so much in the cities as in the opposition to the surrender of the highways outside of them; second, and of much greater moment, the resistance of the steam railway corporations, which own or control properties representing not less than $200,000,000, at present market values.

A large number of new projects awaited the authority of the legislature of 1891—so many that, when the partisan deadlock which made the session a blank began in that year, it was predicted freely that the electrical interests would force a settlement. But no settlement was made, and the effect of the legislative *hiatus* of two years was to mass new enterprises for the next general assembly—that of 1893—on which they descended in a flood. They were resisted stoutly by the steam companies, but, by alliance with the "granger" element in the lower house, won a victory—on a question of the powers of the Railway Commission over new trolley projects—which forced, as a compromise, the general electric law now on the statute books of this State. Its most salient provisions are: (1) local control—by mayors and common councils in cities, wardens and burgesses in boroughs, and selectmen in towns—of layout, track, speed and equipment of electric roads; (2) compulsory maintenance by the company of the street between tracks and of two feet on each side; (3) right to carry both passengers and freight on approval of the Superior Court; (4) parallels of steam roads to be amenable to the same jurisdiction—with power of appeal on questions of law to the Supreme Court; (5) towns, cities and boroughs, as well as the companies, to be liable in certain cases for damages; (6) the word "street" to include bridges; (7) registration of all bonds with the State comptroller, and bonding to be limited to three quarters the cost of construction and equipment, this clause, however, allowing special charters to override the bonding safeguard, and thus giving rise to dangers which have been realized; (8) compulsory exchange of traffic under orders of the courts; (9) annual returns to the State Railway Commission. By a statutory flaw, however, returns were ordered on Oct. 1 of each year up to and including the day before. This has essentially nullified the provision of the statute for returns and made a travesty of many of such returns as have been handed in; and in consequence there are now few trustworthy official statistics of Connecticut street railways and no official compilations.

The legislature of 1889 passed a bill which prohibited grade crossings of steam railways by horse, cable and electric roads. But in the next working legislature of 1893—the deadlock having intervened—the electric companies secured a modification of the law, so as to legalize those crossings, if approved by the Railway Commission. That body, which, from the first, had opposed the crossings, while allowing them in some cases, took a rather resistive attitude. Then a long and sharp legal contest ensued over the question of the right of electric companies which by charter had been granted the special privilege to cross at grade to override the general law. In the test case—that of the Bridgeport Traction Company against the Consolidated Company, involving a very dangerous grade crossing at Bridgeport—the latter corporation won in the lower court, but, by a divided bench of three judges to two, was defeated on appeal, one of the points raised being the priority in time of operation of the charters as against the general statute. Meanwhile great popular opposition had arisen against grade crossings of steam and electric roads, and at the end there was a kind of race between the legislature and the traction company, which needed the court's final order before laying its rails. The legislature won; a terse bill absolutely prohibiting grade crossings was literally "railroaded" through the general assembly, and is the law to-day.

While, owing chiefly to the legislative deadlock, the period of active electrical expansion has spanned but a little more than 29 months, the statistics of growth are impressive. In January of 1893 there was in single track a total of 147 miles (approximately) of street railway in the State, of which about 81 miles were operated by horsepower and 66 miles by electricity. There are now about 289.0 miles, of which all but two short roads with some five miles of track are electrically equipped.

Actual investment in street railway properties of the State it is impossible to compute. The latest statements of the corporations show roughly an issued capital stock of $8,566,000, and bonded debt of about $6,662,000. But, owing to stock inflation, the actual investment is far below the total ($15,228,000) of the two. The old roads, when electrically equipped, have shown the wonted increase of business. For example, one important line, on an increase of mileage of 57 per cent. returns for 1894 (electric) over 1893 (horse) a gain of 72 per cent. in gross earnings; another line, of about 12.5 miles, shows, with an increased mileage of 14 per cent., a gain of 81 per cent. in 1895 (electric) over 1894 (horse); while a small road shows for the same years a gain of more than 100 per cent. for electricity, with an increased mileage of but 29 per cent.

The figures for total mileage in the State show about 97 per cent. increase in single-track miles within the period of 29 months. In January of 1893 there were 22 distinct street railway corporations operating their lines. There are now not more than 24, although single-track mileage has increased 97 per cent., showing the swift process of both extension and absorption which has followed the introduction of the trolley. The increase in not a few cases has been too speculative. New roads too often have been built crudely, and crudely equipped, "financed" on bonds under "special" charters, while the stock has been held with partial or even no payments at all, and to a degree the first impacts of the trolley, under the auspices of foreign capital, have duplicated the kiting epoch of steam railway building brought to so disastrous a climax in 1873.

Of "projected" trolley roads—using the quoted word in its most ample sense, from actual layout to speculative hope—there are about 41 enterprises in the State reaching over some 381 miles of single track, some of them extensions.

The effect of trolley roads in the State as parallels of the steam lines is a subject upon which clearer light is thrown than on some other phases of the steam-trolley problem. Counsel of the Consolidated road has presented at a committee hearing in Hartford the annexed figures of loss in number of passengers, for the two periods of six months each, ended with February of 1894 and February of 1895, to show the effect of parallel competition up to that time.

The whole number of passengers for the stated periods of 1894 in the foregoing tables was 268,714 on about 55 miles (allowing for duplications) of the Consolidated road, and the decrease due to about the same total distance of trolley parallels was 146,301, or a little more than 54 per cent. Carrying out the ratios so as to obtain a full year's computation, the loss of the Consolidated Company would be represented by 339,744 passengers. The figures look large, but are not so impressive when reduced to dollars, where the liberal estimate is made of 2¼ cents loss per passenger per mile, viz.: $32,461.

The loss of $32,461 is partly offset by the economies of steam service presented by the withdrawal of one train between Waterbury and Naugatuck, and probably much further by additional business fed the steam road by lateral trolleys; and even the parallels must also have contributed something to general business to partly offset their competition. But, taking the sum as it stands, it represents but about ⅛ per cent. of the gross receipts ($25,576,884) of the Consolidated Company's whole system in four States. At the same time it is to be remembered that the loss by immediate competition tends to increase, and that Connecticut losses of the Consolidated Company represent but a part of the total which has its larger fractions in Massachusetts and suburban New York. It may be noted that operated trolleys now paralleling steam roads in the State represent a total of about 91 miles.

Since the opening of the present year the story of the campaign of steam against the trolley has been, both in the courts and the legislature, a well-nigh unbroken set of reverses for the electric companies. In the Superior Court, on the 10th of last April, Judge Hall made a most important ruling on the application of the New Britain Central Railway & Electric Company to build a trolley line between that city (of about 32,000 inhabitants) and Hartford, some nine miles distant. The case fell under the provision of the general electric railway law, which forbids a line parallel to a steam road unless the projectors shall have satisfied a Superior Court judge of its public necessity and convenience. Judge Hall found against it on the question of fact, holding, apparently, that the rule of public convenience and necessity applied with equal force whether a trolley company owns its roadbed or is laid upon a highway, and that upon the street railway rests the burden of proof. As the steam companies claim unlimited power to multiply trains, especially if equipped hereafter with trolleys, this burden of proof may prove an obstinate barrier to parallel trolley enterprises, if Judge Hall's opinion prevails.

But it has been in the present legislature that electricity has met its most serious defeats. Under adverse committee reports parallel after parallel has been thrown out. In two of these cases the deadly decision was made by the railway committee that electric companies intending to own their roadbed must come in under the general steam railway statute passed 20 years ago, and expressly intended by the Consolidated Company to impede steam parallel schemes.

Intelligent public opinion in Connecticut, as distinguished from partisan opinion, on the one hand, and mere ignorance on the other, has passed through two stages and is now in a third. At first it was distinctly hostile to the trolley during the period when electric transit was in its first ventures, when its equipment was bad and when the noisy roads were deemed by many a crying nuisance. Later, as the system developed, public sentiment in both city and country became much more hospitable, and it was during this epoch that many streets and highways were rashly surrendered and valuable franchises granted without returns and with very inadequate restrictions or none. Since then there has been another reaction against the trolley, but along more rational and moderate lines. Popular judgment evidently favors now higher taxation of the trolley companies, the jealous preservation of the country highways both for present needs and future improvement, making the trolley companies pay for occupying the city streets, and sharp checks on speculative financiering of trolley schemes.

Progress and Prejudice.

BY W. M. STINE.

The history of the introduction of past inventions and innovations contains many suggestions which are of signal application at the present time. To anticipate what may occur is, in the main, safer than to prophecy what will not take place. The current year bids fair to have much historical importance attached to itself. The Metropolitan Elevated, of Chicago; the Nantasket Beach Line, and other short railways upon which electricity is being introduced, have made this a leading question—"Will electricity displace the steam locomotive?" Those who have attempted to reply, and others debating, would do well to consider the discussion which arose in the early part of the present century over the introduction of the steam railway. Two citations are appropriate and decidedly to the point:

"The opposition to railways at the commencement of their career is now a matter of history, and we can only look back with astonishment at the shortsightedness of our grandfathers; yet we must remember that the views of the general public were guided by persons who were supposed to be experts in engineering science, the majority of whom, in their narrow-minded ignorance and lack of enterprise, did all they could to stamp as folly the ideas of such men as George Stephenson and the other early promoters of railways and steam locomotion." And again, writing on this subject about this time (1829), the *Quarterly Review* said :

"As to those persons who speculate on making railways general throughout the kingdom, and superseding all the canals, all the wagons, mails, stage coaches, post chaises and, in short, every other mode of conveyance by land and water, we deem them and their visionary schemes unworthy of notice. The gross exaggeration of the locomotive steam engine (or, to speak in plain English, the steam carriage) may delude for a time, but must end in the mortification of those concerned. We should as soon expect the people to suffer themselves to be fired off upon one of Congreve's ricochet rockets as to trust themselves to the mercy of such a machine going at such a rate."

These quotations are from " British Locomotions," by C. J. Bowen Cooke, pp. 17 and 21.

Comments and Views of Contemporaries.

Speed Demanded.—Speed is the thing now most desired by the patrons of railways and, therefore, by the railway managers themselves. If 150 miles an hour can be made with safety by an electric motor the fastest steam locomotive becomes by contrast a stage coach or canal boat. It must necessarily give way to modern demands.—*Cincinnati Times-Star.*

A Revolution in Railway Service.—The action of the Westinghouse Electric Company in combining with the Baldwin Locomotive Works shows that the electric motor industry has become a reality. This change of motors will work a revolution in railway service throughout the world, increasing the speed of trains, and in giving people a quicker relation to one another than they had before. The electric locomotive will be introduced in many places in competition with trolley companies, where the railways are obliged to act in self-defense, and the coming change will in this way receive a tremendous boom.—*Boston Herald.*

Excursions on Trolley Cars.—Notwithstanding the perils to life and limb which the introduction of electric railways has brought, there can be no question that the new method of transit is a boon to all classes in our tropical Summer. It has promoted the public health by giving cheap, rapid, airy and comfortable access to our delightful environs. As an incidental benefit, which cannot be computed in dollars, the coming of electric transit has, within two years, transformed many miles of wretchedly paved streets into smooth thoroughfares, which are thoroughly scoured by the showers from the skies if not by the city hydrants. Nearly every street railway line has its terminus in a distant suburb, and poor indeed must be the city denizen who cannot find the fresh fields and pastures new which the trolley cars which Oliver Wendell Holmes felicitously calls " the broomstick train," have discovered for him. These pleasant paths are open to him in every direction.—*Philadelphia Public Ledger.*

Substitution of Electricity for Steam.—The steam railways are discovering that as a means of self-protection against competing electric roads, in suburban traffic, for instance, they are likely to be compelled to make extensive use of the new agent. Electricity permits, and its profitable employment requires, that its motive force shall be put to constant service. By its means trains can be run with very brief interruptions and at small proportionate expense, and hence its superiority to steam on the short distances of suburban travel, so enormous in amount, seems to be unquestionable. It would enable a railway to run its trains in almost continuous procession, so that the traveler would find the transportation ready for him whenever he arrived at the station, or, at most, he would have to wait for it for a few minutes only. He would not have to consult a time table and exhaust himself in hurrying to catch a train to save himself from a cold dinner, or from the reprobation of his employer.—*New York Sun.*

The Fairmount Park Road.—The certainty that a trolley line will be built in the park makes the where and how of its construction of vital moment to all lovers of the city's great pleasure ground. Properly constructed upon lines that will make it both unobtrusive and free of danger to the thousands of all ages and conditions who visit the park, its advent will prove a great public benefit, for it should ever be kept in mind that Fairmount Park is the pleasure ground of the great mass of our citizens who can neither keep nor hire carriages. Under existing conditions they must take long walks to visit its many interesting features that are impossible for the women and children and those of advanced age or enfeebled condition.—*Philadelphia Ledger.*

Watering Stock.—Mr. Nixon, chairman of the Special Assembly Committee which is investigating the railway systems of the State, has said that it is probable that the committee will recommend that the legislature pass a law prohibiting the watering of stock. He would have the stock represent the money honestly invested. In other words, he would have every dollar of stock represent a dollar of money. There are many investors in Brooklyn who wish that such a law had been passed long ago. Whatever may be said of stock watering theoretically, its practical effects are bad. It is really a system under which its promoters expect to get something for nothing. It is, in fact, a device of the professional promoter. The Brooklyn railways are suffering to-day from too much promotion. When the motive power was changed from horses to electricity it was practically necessary to rebuild the entire roads, and to raise money for the purpose capitalists were called in. They were high-priced men. They were not in the habit of doing work for nothing. The amount which the rebuilding of the roads honestly cost was large, and the amount which the public was told it cost was much larger. The difference between the actual and announced cost was hundreds of thousands of dollars. There are people who say it was millions. No one knows the exact sum except the handful of men on the inside. The men who owned stock in the roads before the reconstruction are robbed of a part of the income to which they are entitled, for it goes to the promoters on stock, which represents not a cent of outlay for materials or for track or cars or engines or motors or dynamos. If stock watering were forbidden the opportunities for unscrupulous men to take advantage of investors would be reduced. If only such stock were issued as represented honest expenditure of money it would be known to every one what a dividend of 6 per cent. meant. But when stock is watered no one knows what a 6 per cent. dividend means.—*Brooklyn Eagle.*

Electric Mining Locomotive.

The electric locomotive shown in the accompanying illustration was designed by the Link Belt Machinery Company, of Chicago, for coal mining work. The machine is four-wheeled and is operated by a single motor. It is run at eight miles an hour, pulling trains of from 30 to 40 loaded bank cars. It weighs 10 tons and is built in accordance with the best engineering principles. The drivers are provided with soft steel tires shrunk on and riveted, and since all four of them are geared to one armature shaft, they are compelled to revolve at identically the same speed, thus further increasing the tractive effect. Notwithstanding the fact that both axles are geared to the single armature shaft, they are free to take various positions with reference to one another, owing to track irregularities, without throwing the gears out of alignment. The entire mechanism is confined to the space between the drivers, as Fig. 2 clearly shows; this is a valuable feature in mine work where the passages are narrow and space outside the rails is not to be depended upon. Each locomotive is provided with an arc lamp headlight. A special form of small arc lamp, passing three amperes, is mounted with the arc at the focus of a parabolic reflector. With this bright light it is possible for the motorman to run at a much higher speed than would be possible under different circumstances. Fig. 1 shows one of these lamps without the reflector. The locomotives bring the coal from points in the mine to the foot of the slope, which is about 200 feet underground. Thence the coal is taken up the slope to the tipple in trips of four or five cars by a rope.

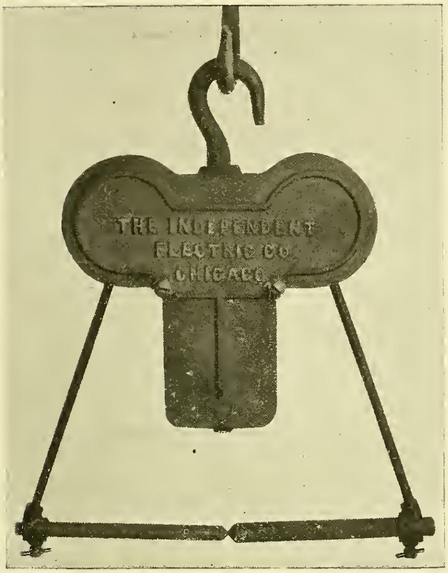


FIG. 1.—HEADLIGHT WITH REFLECTOR REMOVED.

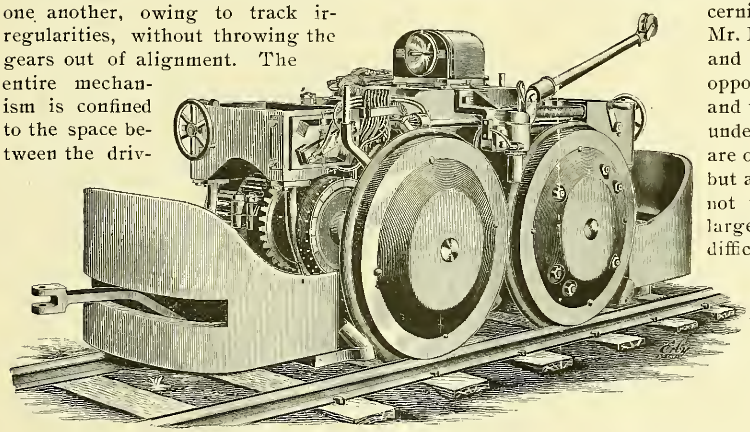


FIG. 2.—EIGHTY-TON ELECTRIC LOCOMOTIVE.

The power house from which the locomotives as well as an equipment of electric mining machines are operated, is 130 feet long by 56 feet wide. One end is occupied by the boilers, feed-water pumps and feed-water heater; in the centre is the engine and dynamo room, and at the other end is a machine shop, blacksmith shop and locomotive room. There are four boilers, each 72 inches in diameter by 18 feet long and containing 64 4-inch lap-welded tubes. The water is taken from two artesian wells, drilled in the boiler room for that purpose. There are three single-expansion Corliss-type engines, each capable of delivering 250 hp at 150 revolutions, with steam at 100 pounds pressure. Each engine is belted to a 150-kw "Independent" mining type dynamo. These are inverted horseshoe bipolar machines of especially substantial design, and are well adapted to stand the severe strains and heavy overloads to which mining work subjects them. They are fitted with self-oiling, self-aligning journals, ventilated armatures and clamped carbon brushes.

The generators are connected to the switchboard by 400,000-circ. mils flexible cables leading overhead. The switchboard is of white Italian marble, in three panels, fitted with Weston instruments and the usual complement of switches, and very handsomely finished.

To Study Electric Railways.

M. Marechal, the chief engineer of the City of Paris, has just reached the United States and proposes to study electric railways, especially conduit roads. He is now in Washington investigating the underground system recently completed by the Metropolitan Company. Concerning the street railways of Paris, Mr. Marechal states that the authorities and people of that city are very much opposed to the overhead trolley system, and would not permit its introduction under any conditions. Three systems are operated in Paris by compressed air, but according to Mr. Marechal these do not work satisfactorily, owing to the large expense incidental to operation and difficulty in preventing the freezing of the compressors in Winter. After examining the underground system in Washington Mr. Marechal will visit New York to investigate the Lenox Avenue system.

Ordinance to Prevent Accidents.

A committee of the council of Newport, Ky., is preparing an ordinance which shall prohibit children from playing on streets where electric cars are in operation. It is believed that if the ordinance is properly enforced, the number of accidents will be materially decreased.

FINANCIAL NOTES.

LOS ANGELES, CAL.—The contemplated foreclosure sale of the Los Angeles Consolidated Railway property was again prevented last week by the issuance of an injunction, of which the restraining order by Judge Smith was a forerunner. A complicated state of affairs is thus brought on.

TRACTION EARNINGS.—The receipts of the People's Traction Company on last Saturday were $7,969, an increase of $3,214, and on Sunday they were $7,724, an increase of $2,645, and the earnings of the Hestonville, Mantua & Fairmount Passenger Railway Company for Aug. 17 and 18 aggregated $3,045.46, an increase of $1,667.27, compared with the same two days last year.

EARNINGS OF THE NASSAU COMPANY OF BROOKLYN.—It is stated that the Nassau Electric Railway of Brooklyn has gained each week it has been in operation in the number of passengers carried. On Aug. 11 the receipts were $2,900 and it was impossible for the road to carry the people who wanted to ride. The average receipts during the week ending Aug. 18 were about $1,700 a day.

CHICAGO, ILL.—The report is again current that the Chicago City Railway Company proposes to retire its bonds by an issue of stock. The company has outstanding $4,619,500 mortgage bonds, bearing interest at the rate of 4½ per cent. Under the mortgage these bonds may be redeemed at any time on 60 days' notice. On the Stock Exchange last week there were sales of $16,200 of the bonds at 101½.

DAVENPORT, IA.—The stockholders of the Davenport & Rock Island Street Railway Company met in the office of Secretary J. F. Lardner last week and voted 6,544 shares to 169 to reorganize the company. It has 30 miles of electric road in the three cities of Davenport, Rock Island and Moline, and has been prevented from paying dividends by the fact that it has had paving assessments of over $150,000 to pay within the past two or three years.

APPLETON, WIS.—The City Council has directed the city attorney to proceed legally against the Appleton Electric Street Railway to compel the performance of its share of the necessary work for grading and paving on College Avenue, Second Street and Meade Street. Resolutions were adopted declaring the charter of the company null and void, because of the failure of the company to operate cars in accordance with the terms of its franchise.

UNION TRACTION BONDS.—It is generally expected that the new Union Traction Company's bonds will become a favorite form of investment among Philadelphia investors, and it is understood that the syndicate of bankers which has the floating of them anticipates materially higher prices. The bonds will be in convenient form for investors of all classes, *i. e.*, $100, $500, and $1,000. Aside from this feature the market for the bonds, it is thought, will be always a ready one, and investors, moreover, will be at no pains to learn what the company that issues them is doing in the matter of earnings, etc.

DECREASE IN BROOKLYN HEIGHTS RECEIPTS.—During the month of July the receipts of the Brooklyn Heights Railway are said to have been about $50,000 less than they were in the corresponding month of last year. The reasons given for this falling off are the bad weather, the decreased speed, the boycott by the labor element and the new system of transfers which had not yet begun to bring in a profit equal to the number of free rides which it provided. On the other hand, the company has secured a coal contract this year so much more advantageous in terms than last as to nearly offset the amount it ran behind in July.

NEW INCORPORATIONS.

THE FLAVEL TERMINAL & TOWNSITE COMPANY, Astoria, Ore., capital stock $50,000, has been formed to buy and sell lands, build railways, electric roads, steamboats, etc., by C. Wingate, Alfred Kinney and D. M. Stuart, Astoria, Ore.

BUENA VISTA LIGHT & POWER COMPANY, Buena Vista, Va., capital stock $25,000, has been incorporated for the purpose of generating light, heat and power. The promoters are S. E. Egolf, R. B. Embree, H. N. Egoff, E. L. Embree, Buena Vista, and Thomas Bohman, Philadelphia, Pa.

THE MOUNTAIN ELECTRIC COMPANY, Summit, N. J., has been incorporated to establish, build, buy, sell and operate electrical plants for generating and supplying electricity for lighting, heating and power purposes. The promoters are Canol Ph. Bassett, Fred Green and Adolph Wagner, of Summit.

AMERICAN SIGNAL & POWER COMPANY, Minneapolis, Minn., capital stock $100,000, has been formed to manufacture electrical and other instruments, devices, apparatus, appliances, novelties, etc. Among those interested are Henry B. Higgins, Charles M. Wilkinson and Charles J. Traxler, of Minneapolis.

THE NEWARK (N. J.) ELECTRIC DEVELOPING COMPANY, capital stock $100,000, has been formed for the purpose of manufacturing electric appliances and machinery, and for selling the same. The promoters are Augustine Demarest, Eugene Eagles, Charles H. Madison, James H. Reinhardt, Newark, N. J.

THE SEATTLE & RAMER BEACH RAILWAY COMPANY, Seattle Wash., has been formed to build, equip, operate, buy and sell electric, cable, steam and other railways, boats and other means of transportation. The promoters are Henry Chapin, E. W. Andrews and Josiah Collins, Seattle, Wash. Capital stock $20,000.

THE RICHFIELD SPRINGS & SCHUYLER LAKE RAILWAY COMPANY, Richfield Springs, N. Y., has been formed for the purpose of building and operating an electric railway one mile long. Those interested in the project are C. B. L. Tylee, F. H. Vielle, C. M. Hyde, G. E. Tylee, all of Corning, N. Y.; capital stock $20,000.

THE PORT CHESTER, RYE, HARRISON & WHITE PLAINS ELECTRIC RAILWAY COMPANY, Port Chester, N. Y., has been incorporated for the purpose of constructing and operating an electric street railway. The incorporators are J. W. Lounsbury, Port Chester; John Duffy, John O'Rourke, F. G. Schirmer, White Plains, N. Y. Capital stock $250,000.

THE DENVER, GLOBENVILLE & GOLDEN RAPID TRANSIT COMPANY, Denver, Col., capital stock $100,000, has been formed to construct and maintain street railway lines and to operate them by electricity, cable, gas or any other motive power. The incorporators are Lewis E. Lemen, George S. Parsons, Irving F. Root, Denver, Col.; R. C. Lingo, North Denver, Col., and S. R. Wright, Highland, Col.

THE STANDARD CAR SEAL & EQUIPMENT COMPANY, Jersey City, N. J., has been incorporated for the purpose of purchasing, manufacturing and selling car seals for the sealing of cars in use upon railways and tramways either operated by steam, electricity or other motive power. The incorporators are George H. Ford, Frederick B. Bard, Brooklyn, N. Y., and Charles N. King, Jersey City, N. J. Capital stock $25,000.

NEWS OF THE WEEK.

UXBRIDGE, MASS.—There is some talk of connecting Milford with Oxford by an electric road.

UNION, N. Y.—Work of grading the electric road between Union and Binghamton has been commenced.

FT. WAYNE, IND.—A franchise has been granted for an electric road from Ft. Wayne to Lake Everett, 11 miles distant.

FRANKLIN, N. H.—An electric street railway will be built by a company, of which Hon. Warren F. Daniel is president.

CAMBRIDGE, PA.—The Borough Council has granted another franchise to the Cambridge & Edinboro Railway Company.

ALLENTOWN, PA.—Work will be commenced shortly on the construction of the Allentown & Kutztown Electric Railway.

PITTSBURG, PA.—The power house of the West End Electric Railway at the south end of Point Bridge was wrecked by a storm recently.

MIDDLETOWN, N. Y.—The Traction Company is seeking a franchise through Bonnell and Stanton Streets to extend the electric road.

ALLEGHENY, PA.—The Pleasant Valley Traction Company has asked the Allegheny Council for franchises to occupy the streets of the city.

HAVERHILL, MASS.—The L. L. & H. Street Railway Company has asked permission to extend its tracks on Hillsdale Avenue to Monument Street.

CAIRO, N. Y.—The Cairo & Windham Turnpike has been purchased by a number of capitalists. who propose to build an electric railway from Cairo to Prattsville.

GLOUCESTER, MASS.—The Gloucester, Essex & Beverly Street Railway was formally opened on Aug. 19, and the event was celebrated by the Business Men's Association.

AYLMER, QUE.—The charter of the Aylmer Electric Railway expires shortly, but the promoters expect to secure an extension of time for the construction of their road.

NEWBURGH, N. Y.—The Homer Ramsdell Transportation Company, of Greenburgh, is behind a syndicate who will build an electric railway from Newburgh to New Paltz.

PHILADELPHIA, PA.—The Moyamensing Avenue & Penrose Ferry Passenger Railway Company has been granted permission to lay tracks on Otsego and other streets of the city.

PHILADELPHIA, PA.—Electricity will in all probability be substituted for steam on the Millstone branch of the Pennsylvania Railway, in the hope of making the road a paying one.

CAMDEN, N. J.—Camden, Gloucester & Woodbury Railway Company has filed a petition and application with the City Council for the location of certain routes of its railway in the city.

TROY, N. Y.—Martin Schenck, of Troy, and T. W. Cantwell, of Albany, are directors of a company which proposes to construct an electric railway between Schuylerville and Greenwich.

SCRANTON, PA.—A charter has been granted to Dunmore Electric Street Railway Company to build a street railway between Dunmore and Scranton. P. J. Horan, of Dunmore, is president.

RICHMOND, VA.—The Richmond Traction Company, composed of Everett Weddey, Reuben Sheriffs, Philip B. Shield, Charles T. Child and others, will build an electric trolley line on Broad Street.

BROOKLYN, N. Y.—President Rossiter, of the Brooklyn Heights Railway Company, has announced that hereafter employees, if in uniform, will be permitted to ride free on any of the cars of the company.

SYRACUSE, N. Y.—Mayor Amos has filed with the city clerk two vetoes of resolutions of the Common Council, one of which was the resolution granting a franchise to the Syracuse & South Bay Railway Company.

NEWARK, N. J.—A franchise has been applied for by the Suburban Traction Company to build an electric line through Union and Nassau Streets and Valley Road. The secretary of the company can be addressed for detailed information.

KNOXVILLE, TENN.—The Citizens' Railway Company has filed application for charter. The company proposes to build and operate an electric line in Knoxville, West Knoxville, North Knoxville and Knox County. It may possibly be consolidated with the West End electric road and the Fountain City dummy line.

MONTREAL, QUE.—The Electric Belt Line is to be pushed forward as rapidly as possible. Messrs. Howard, Leamy & Murphy, who have the contract for the 12 miles of road from Hochelaga to Bout de L'Isle expect to have the work completed in three months.

MEADVILLE, PA.—There is a movement in progress for the construction of an electric railway from Meadville to Edinboro via Saegertown and Cambridge, and the route has been surveyed. Cost of constructing the entire road has been estimated at $400,000.

BOSTON, MASS.—A scheme to build an electric railway between Boston and Cottage City, with a connecting ferry, is receiving serious attention. So far as planned, the road will follow the line of the Old Colony division of the N. Y., N. H. & H. road to Falmouth.

STATEN ISLAND, N. Y.—The application of a number of residents of Staten Island for a permanent injunction, restraining the Staten Island Electric Company from laying its tracks in front of petitioners' property, was denied last week by Judge Gaynor of the Supreme Court.

NEWARK, N. J.—Injunction has been granted by Vice Chancellor Pitney restraining the New Brunswick Trolley Company from building an electric road between New Brunswick and South Amboy. The petitioners are Mrs. Anna M. Clark, a large property owner, and others.

ALBANY, N. Y.—At 71 State Street some 40 representative men from Albany, Clarksville, New Salem, Berne, Gallupville and Schoharie, met and organized the Albany, Henderberg & Schoharie Railway. The directors are B. M. Secor, C. W. Van Valkenburg, L. C. Warner, Jonas M. Brooks, all of Albany, Ezra Twitchell, of Schoharie, and others.

LONDON, ONT.—The London Street Railway Company has called a meeting of shareholders for the purpose of providing the necessary means for electrifying the present system and extending the same, and to authorize the issue of debentures to the amount of $250,000. Work has commenced on the London Electric Railway power house.

MONTREAL, QUE.—The Lachine Rapids Hydraulic Company are going ahead with the construction of their dam by which it is proposed to supply Montreal with cheap electrical power. The contractors guarantee to supply Montreal by May 3, 1897. The dam will be over 4,000 feet in length and the head of water that will be secured it is expected will give the company at least 8,000 hp.

BOSTON, MASS.—The West End Railway Company has contracted to have heaters placed in 750 box cars. As more than a hundred of the company's cars were supplied with heaters last Winter, when the new order has been filled practically the whole road will be equipped with electrically heated cars, for of the 1,800 cars operated by the West End Company only about 900 are for Winter use.

BROOKLYN, N. Y.—A certificate has been filed with the Secretary of State by the Coney Island & Brooklyn Railway Company, setting forth that in consideration of the sum of $10,000, received from the City of Brooklyn, the company surrenders and abandons its franchise and right to lay tracks and maintain and operate a railway on Fort Hamilton Avenue and on the Ocean Parkway, from Fort Hamilton Avenue to the southwestern circle of Prospect Park.

MONTREAL, QUE.—The Central Light & Power Company is making application for a charter for the purpose of constructing and operating works for the manufacture of electrical machinery. Also to enable the company to produce and distribute electricity for lighting, heating and power purposes at different points in Canada. The capital stock of the company is $50,000. The first directors are Richard White, J. C. Bowden and E. H. Barker, of Montreal.

POTTSVILLE, PA.—The Williams Valley Street Railway Company, which several weeks ago received a charter to operate a trolley road in the western end of Schuylkill County, between Tower City and Lykens, will commence the construction of the road within a few days. The right of way has been secured over the whole of the proposed route. The company has a capital stock of $100,000. Charles H. Barmhardt, of Girardville, is the secretary and treasurer of the corporation.

ST. LOUIS, MO.—The Citizens' Railway Company is getting a consignment of 60-foot steel rails with which to reconstruct its track on Franklin and Easton Avenues and Morgan Street. The rails are now being distributed along the line with a long coupled wagon with a tiller arrangement for guiding the rear truck. The work of reconstructing the tracks will begin at once. This is the first road in the country to use the 60-foot rail for street car tracks. They will be welded by electricity, making the tracks continuous.

CLYDE, N. Y.—There is strong talk of building an electric road from this village to Bonnicastle, the summer resort at Sodus Bay, a distance of twelve miles. The Niagara Electric Company, of Niagara Falls, has made an offer to the towns of Galen, Rose and Huron to build the road if the towns will pledge the sum of $10,000. The company guarantees 10 per cent. dividends within three years' time. The proposed road would connect with the Central Hudson Railway at Clyde and with the Rome, Watertown & Ogdensburg Railway at North Rose.

BOSTON, MASS.—The cars of the Lynn & Boston Railway have commenced running over the new elevated bridge between Chelsea and Charlestown. The first car was in charge of General Manager E. C. Foster as motorman and Assistant Superintendent John M. Curley conductor. The car contained as guests of the road Representative F. O. Barnes, ex-Representative M. M. Merritt, Oliver Clark, superintendent of Mystic Wharf; Gilbert Hodges, engineer Long Branch Railway; Purchasing Agent Henry Grover and W. B. Woodward, superintendent of repairs of the Lynn & Boston Railway.

DETROIT, MICH.—Two weeks ago the Grosse Pointe township board agreed to give the Suburban Railway Company a new franchise for a line along Jefferson Avenue, from the easterly Detroit city limits to the easterly limits of the township. Acting upon the agreement the railway company, which is practically the same as the Detroit Citizens' Company, began laying the track. Last night the board met and granted the franchise. It runs for 30 years, and the fare will be five cents straight. All litigation between the township and company is to be stopped, the company paying the costs.

NEW YORK CITY.—The Union Trolley Company is having some trouble with its new line in the Southern Boulevard. The company has recently laid a double track along the Boulevard and at 143d Street, where a branch track of the New York Central crosses, the railway employees declared a blockade against the trolley line. On Monday, however, the workmen on the trolley line managed to get the rails laid across 143d Street, but when they attempted to run a car across the railway tracks on Tuesday they found an engine and three cars on the crossing. The engineer refused to move his train and the trolley car passengers were compelled to transfer to another car on the other side of the crossing.

DETROIT, MICH.—The Detroit Citizens' Street Railway Company yesterday obtained the sanction of the court to the laying of the track in Brush Street, from Jefferson Avenue to Atwater Street, and it may now perfect the contemplated depot loop line. When the company recently applied to the board of public works for a permit to lay the track it was denied on the ground that, if the company ever had any rights in the street under the ordinance of 1862 it had forfeited the same by reason of lapse of time, the life of the franchise having expired in 1892. The company petitioned for a mandamus, and the board filed its answer yesterday, stating its ground for refusal as given above. Judge Donovan decided that the company had rights in the street, that nobody would be injured by the construction of the track, but that, on the contrary, it would be a great accommodation to the public. He granted the mandamus, compelling the board of public works to issue a permit as asked for.

BROOKLYN, N. Y.—Chief Trolley Inspector Charles F. Franklin has reported to Mayor Schieren the result of a new speed indicator made on car No. 134, of the Brooklyn City & Newtown Railway Company. Mr. Franklin speaks of the indicator in the highest terms. When the speed of the car reached eight miles an hour a bell indicated the fact. When a speed of ten miles was reached the regulator cut off the electric current from the motor, thus preventing an excess of speed of ten miles. The device consists of a centrifugal ball-governor arrangement driven from the axle of the car and adapted to actuate a pointer on the indicator dial in the car. The mechanism is also arranged to close the circuit of an alarm bell when the car reaches a speed of eight miles, and at ten miles an hour the governor throws a trip in the controller which releases the controller from its handle and allows the drum to be returned to the zero point by a retractile spring.

BROOKLYN, N. Y.—President Howell, of the Brooklyn Bridge trustees, has sent to Comptroller Palmer, chairman of the committee on surface railway connection with the new Brooklyn station, a plan which he believes will solve the problem which has been bothering the engineers for some time. His scheme contemplates two tracks on Liberty Street, with three tracks at the new station for stands for the Brooklyn City Railway; these stands are to be located so as not to interfere with vehicles from the bridge; the space from Sands Street curb to the rear of the stand will be about 80 feet, thus leaving a large open space for vehicles between curb and car tracks. Vehicles can follow the outgoing cars to the large open space at the junction of Liberty and Fulton Streets, and may then proceed on Clinton, Fulton or Tillary Streets. The Flushing Avenue cars will run down Washington Street to Front Street. The DeKalb Avenue line is to have two stands, about 60 feet from the Sands Street curb. The Jay Street line may curve around High Street into Washingington Street, and the Atlantic Avenue line is to have two stands south of High Street at Washington Street.

TRADE NOTES

AN ATTRACTIVE PAMPHLET, setting forth the advantages embodied in the company's methods, is being distributed by the Electrical Maintenance Company, 50 Broadway, New York. The company, for a fixed sum per annum, holds itself liable to replace, or repair any damage which may befall electrical apparatus regardless of the extent of the injury.

A FLOURISHING BUSINESS is reported by the Delaware Hard Fibre Company, of Wilmington, Del., necessitating the operation of the works day and night, notwithstanding the fact that the size of the plant has been doubled. The company has secured the contract for furnishing the General Electric Company with fibre, and this work alone is sufficient to give employment to quite a large number of hands.

NEW SUPPLY AND CONTRACTING FIRM.—John B. Hoefgen and Edgar C. Moxham have recently established a supply and contracting house in New York, with offices in the Wolfe Building, 80 William Street. They will be in position to supply all kinds of street railway equipment. Mr. Hoefgen was until recently the general manager of the Nassau Electric Railway Company, of Brooklyn. The firm will be known as Hoefgen, Moxham & Co.

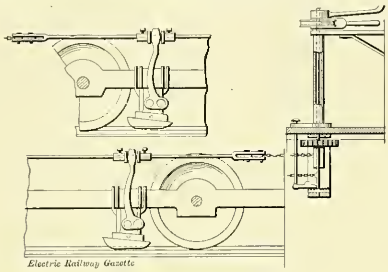
H. J. MEDBERY, president of the Fiberite Company, manufacturers of the well-known Medbery material, recently said: "We find a steadily growing demand for improved grade and quality of supplies. We manufacture only high grades and feel encouraged at the change. Goods of inferior quality are not as much sought after, and, as a consequence, our factory is running twenty-four hours a day. People are building generally for permanency, and want the best material obtainable." The long and practical experience of Mr. Medbery, and the known quality of his goods, have won for the Medbery material an excellent reputation. The company has lately made some large shipments to foreign countries, and this business will be vigorously pushed. Offices have been established in New York, Chicago, Philadelphia, San Francisco and other large cities, in charge of well-known agents of established ability.

THE C. W. HUNT COMPANY, of 45 Broadway, New York, has just issued a new catalogue devoted to a description of its coal-handling apparatus for steam plants. The little volume is one which will be found of great interest to all those concerned in the operation of steam generating plants. It is thoroughly illustrated with admirable half-tone engravings showing some of the important plants in which the Hunt coal-handling apparatus has been introduced. One of the interesting prefatory statements made in the catalogue is the following: "Taking coal from the hold of a vessel which comes at irregular times, storing it in a 6,000-ton pocket 800 feet distant, taking it from the pocket and delivering it continuously, day and night, to the front of the boilers, for a total cost, including the interest on the investment, of less than 3½ cents per ton, from the hold of the vessel to the boiler furnaces, manifestly requires a large expenditure for machinery. But the reduction of the cost of handling 25,000 tons of coal per annum from 27½ cents to 3½ cents per ton pays a net profit, above interest and all expenses, and available for dividends, of $6,000 per annum."

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED AUGUST 13, 1895.

544,283. CONDUIT FOR ELECTRIC CONDUCTORS FOR RAILWAYS; Frank L. Capps, Newark, N. J. Filed Sept. 18, 1894. The conduit iron forms a slotted passage for the car shoe, and manholes are arranged at substantially uniform distances apart. Shear-like arms are arranged at the manholes extending into the plane of the said shoe passage so as to be operated by the moving shoe. The extensions of the arms, opposite those engaged by the shoe, carry electric circuit terminals which are changed in relation by the shoe engagement to affect the circuit.



No. 544 489.—TRUCK.

544,302. COMBINED WHEEL AND RAIL BRAKE; John B. Hoagland, Benjamin W. Thornhill, and Jacob M. Kinsey, St. Louis, Mo. Filed June 18, 1894. The brake shown is designed to be attached to the frame of the car in the ordinary way, with the exception that the brake beam to which the brake shoes are attached is pivoted at a point in a plane below the centre of the wheels, so that the track shoes which are pivoted to ears on wheel shoes will come in contact with the rails when the brake is applied. Two parallel rods extend the full length of the brake beam, one of which is located in perforations in the wheel shoes, and the other movably connects the track shoes to and independent of the movement of the wheel shoes. A series of links, which are perforated near their ends, are mounted on the parallel rods and have upwardly extending rods connecting them with foot levers on the platform of the car.

544,306. CONDUCTOR FOR ELECTRIC RAILWAYS; Paul C. Just, Chicago, Ill., assignor to Albert G. Wheeler, same place. Filed Feb. 6, 1893. Clamps are rigidly fastened to the ends of two contiguous conductor sections, and provided with means for their suspension. An intermediate conductor section is supported by the clamps, but is free to slide longitudinally therein. An elastic connection is interposed between the clamps and tends to draw them together, whereby the distance between them may vary with the expansion and contraction of the conductor sections.

544,312. TROLLEY FOR UNDERGROUND ELECTRIC RAILWAYS; Myron D. Law, Washington, D. C., assignor to Albert G. Wheeler, Chicago, Ill. Filed Jan. 31, 1894. This is a trolley for an electric railway with a slotted conduit and two line conductors. The traveling contact device embraces two trolley wheels or contact pieces moving in contact with the line conductor. A supporting bar extends through the conduit slot, insulated connecting wires extend from the trolley wheels or contact pieces along the supporting bar to opposite terminals of the motor. Fusible couplings or fuses are interposed between the trolley wheels or contact pieces and the connecting wires, the couplings or fuses being constructed to carry a current greater than the current-carrying capacity of the motor, but less than that supplied by the generator, whereby grounding of the current through the trolley wheels or contact pieces in contact with opposite line conductors will cut out one or both of the motors which are in circuit with the defective conductors.

544,313. TRAVELING CONTACT DEVICE FOR ELECTRIC RAILWAYS; John C. Love, Philadelphia, Pa., assignor to the Love Electric Traction Company, Chicago, Ill. Filed Sept. 5, 1893. The traveling contact device comprises a supporting bar, a trolley wheel or contact piece, a trolley arm mounted to oscillate in a plane parallel with the line of travel of the contact device, and consists of three parts, of which the inner one is connected with the intermediate one by a pivotal joint the axis of which is longitudinal of the arm, and the intermediate one is connected with the outer one by a transverse pivot pin rigidly attached to the outer arm and extending through and adapted to turn in the end of the intermediate one. A lifting spring, a restraining member, and a connecting arm are attached to the pivot pin, and reach to a point laterally distant from both the longitudinal and transverse axes of the pivotal joints.

544,327. SAND-BOX; Henry Springstube, Allentown, Pa. Filed April 15, 1895. This is a two-part sand-box, each part having a stirrer fixedly mounted thereon and a boss centrally disposed and an interposed plate having a central pin extending above and below the plate, and held in the bosses, and springs bearing upon the under side of the plate.

544,391. ELECTRIC RAILWAY CONDUIT SYSTEM; Lorenzo H. Sherwood, Mount Vernon, N. Y. Filed Sept. 7, 1894. A tubular insulated secondary conduit is supported within the main conduit entirely out of contact with all of the walls of the latter and is provided at one side with a slot and with a wire tube. The service wire is supported longitudinally within and above the bottom of the secondary conduit and the main conductor is supported within the main conduit outside of the secondary conduit. A branch feed wire is passed through the wire tube and connects the service wire with the main conductor. A longitudinal guide rail is arranged within the secondary conduit above and parallel with the service wire, and the compoundly curved trolley arm carries within the conduit a vertically disposed double bearing frame having a lower trolley wheel which travels on top of the service wire and an upper guide wheel which travels beneath and against the guide rail.

544,404. CAR FENDER. John S. Detwiller, Philadelphia, Pa. Filed Jan. 2, 1895. The fender comprises a tubular frame supporting in an inclined position a carrier-apron. The frame is provided with cross-rods or pintles oblong slotted slides or bearers with end sockets, retracting springs connected with the fender frame and with a platform of the car. A foot lever is in movable engagement with a bell crank lever which is linked to the frame, the lever being fulcrumed to a bearing on the under side of the platform of the car.

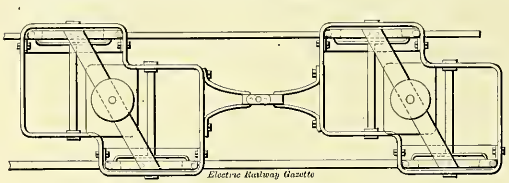
544,417. TRUCK FOR STREET RAILWAY CARS: Louis T. Pyott, Philadelphia, Pa., assignor of one half to Daniel E. Waters and William G. Vernon, same place. Filed March 12, 1895. The car truck has axle boxes rigidly attached to a suspended side framework of integral bars, which extends beyond the wheels. The two sides of the frames are connected at each outer end by a cross tie having pivotal connection for vertical radial movement with each side framework.

544,471. TROLLEY WHEEL AND BEARING; Edmond Verstraete, St. Louis, Mo., assignor of one third to Ernest G. Bruckman and Samuel E. Bruckman, same place. Filed Nov. 22, 1894. A carbon journal bearing is mounted in the box in which a vulcanized fibre plate is mounted. A shaft is mounted in the box resting on the carbon and abutting against the fibre plate, whereby flow of current through the ends of the shaft is prevented, a cap confining the shaft within the box.

544,489. TRUCK FOR STREET CARS; George F. Shaw, Dedham, Mass. Filed Nov. 1, 1894. The trucks for street cars consist of two frames connected together by bars having a sliding pivotal joint, each of the frames being pivoted centrally to the car body and provided with two independent axles. Each axle has one wheel only and is provided with boxes at each end, one wheel being forward of the pivot to the car body and the other at the rearward of the pivot in each of the truck frames. (See Illustration.)

544,504. STREET CAR SIGN; Jerome H. Deters and Charles Kiechler, Cincinnati, O.; said Kiechler assignor to Amos Dye, same place. Filed April 22, 1895. This is a revoluble or changeable route sign or indicator for street cars, and combines an open skeleton frame having guide-ways therein and suitably trunnioned end-heads; one or more sign slides composed of stenciled metallic front-faces and fillings of colored glass or other similar suitable transparent material, and adapted to engage the guideways; an elbowed central shaft made of tubing and on which the frame and its sign slide or slides are mounted; one or more incandescent electric lamps mounted on the shaft and adapted to diffuse light through the colored glass and stenciled letters of the sign slide or slides; barrier plates or catches adjacent to the outer ends of the sign slide or slides, and suitable bearing standards for the resting of the trunnions of the frame.

544,565. CAR FENDER; Samuel A. Darrach, Newark, N. J., assignor to the Darrach Car Fender Company, same place. Filed April 25, 1895. The fender has its receiving part composed of elliptic springs, each of which is formed of a single spring strip looped at about its centre, and having its looped part secured at the front or striking part of the fender, and having its free ends secured at the rear of the fender.



No. 544,574 —SAFETY BRAKE.

544,574. SAFETY CAR BRAKE; Jefferson U. Elwood, McKeesport, Pa., assignor to himself and Duane P. Smith, same place. Filed Jan. 16, 1895. Brackets are secured to the car truck, and here are vertically transversely slotted brake shoe holders in the brackets. The brake shoes are secured to the holders and adapted to engage the rails. The levers are fulcrumed on the brackets and have projections engaging the transverse slots in the holders, the cross levers connecting the rods. Means are provided for imparting a longitudinal movement to the rods. (See Illustration.)

544,623. SNOW PLOW; Joseph Leightham, Reading, Pa., assignor of one half to William H. Slichter, same place. Filed March 14, 1895. The plow has the rear upright frame and the bottom frame extending downwardly and forwardly therefrom with the front edge. The bottom rotary shaft extends completely across the bottom of the plow near the front thereof, and the upper wedge-shaped portion has the concaved sides and a sliding wing in a concave side. The plow is pivotally joined to a car front, and yieldingly held in its normal position by springs.

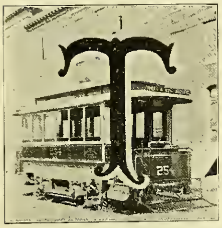
Electric Railway Gazette.

Vol. XIII. NEW YORK, AUGUST 31, 1895. No. 9.

Electric Car Tests.

BY HERMANN S. HERING, M.E.,
Assisted by
CHARLES REUTLINGER and B. HARRISON BRANCH.

I. PRELIMINARY DESCRIPTION.



THESE tests comprised a determination of the performance of electric cars of various kinds under definite conditions of load, speed, grade, track, etc., with a view to obtaining empirical data for these conditions which would at the same time have a fair degree of accuracy.

The general conditions affecting the performance of electric cars are :

a. Character of the electrical equipment of the car, including motors, controllers, trolley connections, etc.

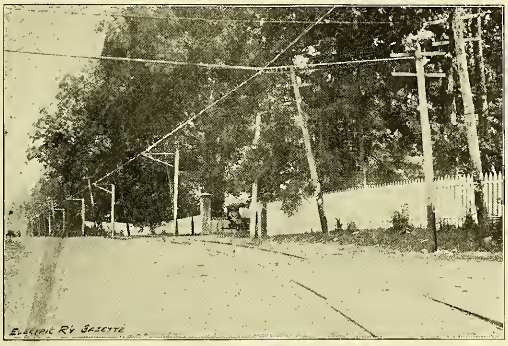


FIG. 2.—OLD TRACK AT TOP OF 5.96 PER CENT. GRADE, LOOKING TOWARD BALTIMORE.

b. Mechanical equipment, including trucks, wheels, etc.

c. Character and condition of tracks and roadbed, affecting the traction coefficient and speed limit.

d. Curvature.

e. Grades.

f. Line resistance ; including feeders and return circuit.

g. Potential difference of the line ; including the drop and the variation due to other cars.

h. Load ; number of passengers, trailers, etc.

j. Number of stops.

k. Schedule run ; whether express, accommodation, etc.

l. Wind resistance.

m. Controller position ; motors in series or parallel or with resistance.

n. Character of operation by the motorman.

The quantities involved in the performance of the cars, and affected by these conditions, are :

p. Potential difference applied.

q. Current used by the motors ; including the division between the motors ; consequently the

r. Electrical horse-power applied to the motors.

s. Watt-hours required for any portion of the road or the total.

t. Watt-hours per car mile.

u. Losses.

v. Speed.

w. Traction coefficient.

x. Net efficiency.

In making these tests the conditions were maintained as nearly constant as possible, and only two variables allowed to enter, except in some cases where three were necessarily involved.

The two roads on which the tests were made differed materially in the character of their construction and operation and the three motor cars that were used had different electrical equipments. By running these cars on the two roads under similar conditions, and on the same road under different conditions, and also running the cars on steady grades at steady speeds and different loads, etc., considerable data was obtained that involved but few variable and uncertain conditions. The two conditions most difficult to eliminate were the wind resistance and the traction coefficient. There being no feasible way of determining the former, all tests made on very windy days were discarded or else the fact was noted in the results, and the tests can be said to have been made when the wind velocity was small compared with the velocity of the car, and the tests on steady grades were all made either on the same day or on days when the wind direction and velocity were practically the same.

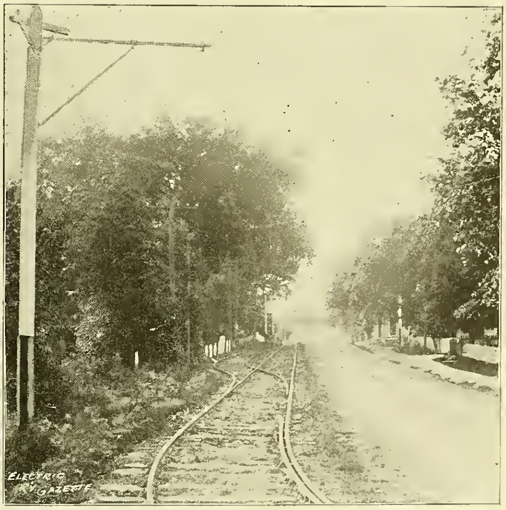


FIG. 3.—OLD TRACK NEAR PIKE TURNOUT, LOOKING TOWARD PIKESVILLE.

Reliable and useful data on the wind resistance of electric cars, which becomes such a large part of the total work done at high speeds, is greatly needed, and it is hoped will soon be determined. The traction coefficient of an electric car is an uncertain and variable quantity, and seems to be anything but "constant." Theoretically it is the ratio of the horizontal force required to pull the car on the level, and the weight of the car; and it is given in pounds per thousand, or pounds per ton (of car weight). This ratio is supposed to be constant, but unfortunately varies within a wide range.

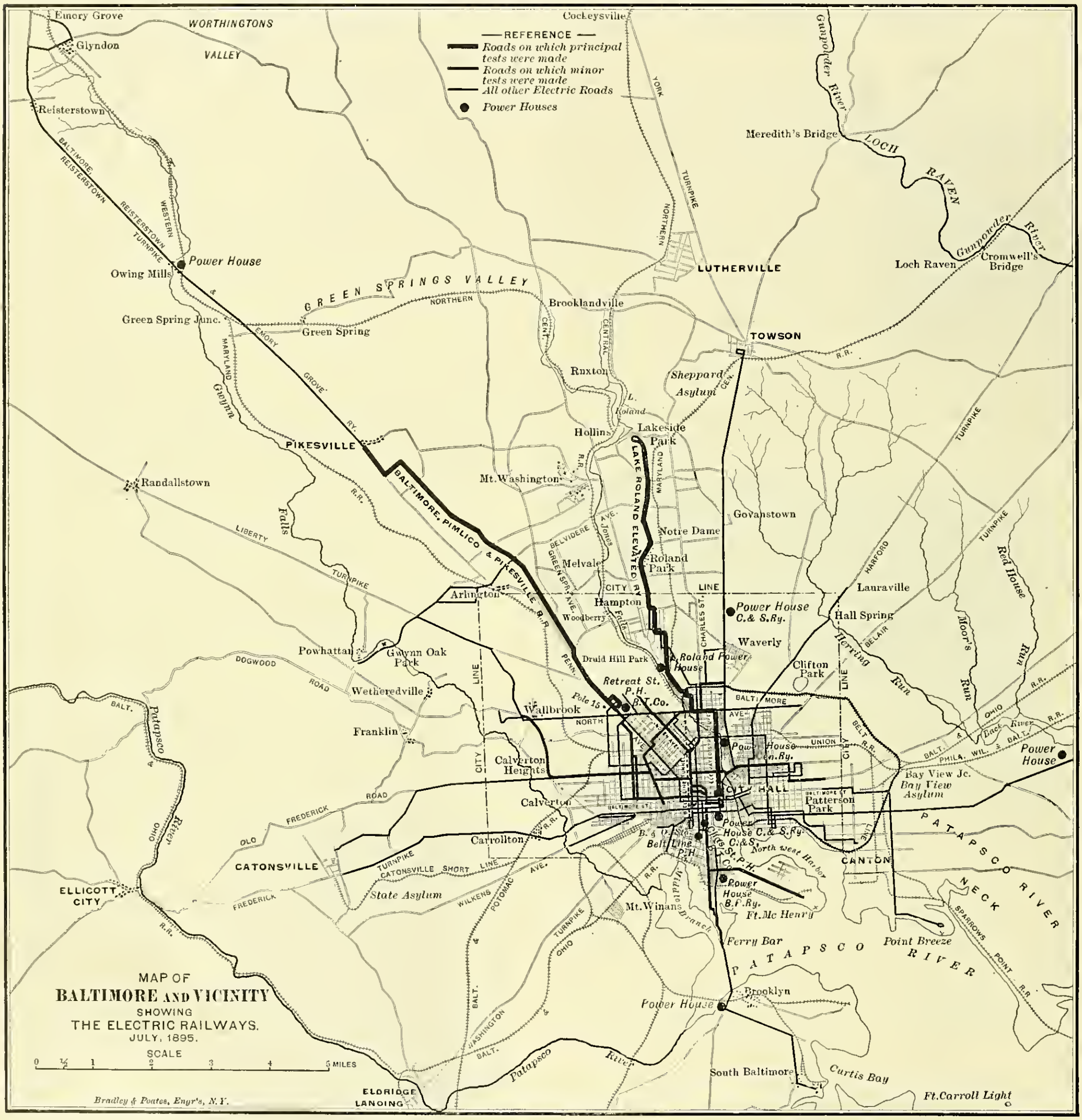


FIG 1.

The weight of the car and load, the wheels, their shape and "age," the car journals, the shape of the track, its surface, whether wet or dry, smooth or rough, dirty or sandy, degree of curvature of the track and shape of the groove, switches, crossings, etc., all have an effect upon this ratio and alter its value. For the purposes of these tests the traction coefficient of the cars was carefully determined on various parts of the roads and an average taken, but only in a few tests did it enter at all as a part of the result.

The civil engineering data of the road was obtained from carefully made surveys. The weight of the cars was obtained frequently by means of car scales. The weight of the passengers on special tests was actually determined, but on tests during the regular service of the car were estimated, but this latter weight did not enter materially in those tests as no computations based on the weight were made; whenever necessary the weights are correct within a few pounds.

The electrical measurements were made with Weston instruments, the watt-hours were determined by means of a portable Thomson recording wattmeter, the speed records by a Boyer speed recorder, the draw-bar pull by a Giddings recording dynamometer, and the time readings were taken with calibrated watches or with a chronometer. All of these instruments were carefully calibrated as often as necessary and the readings corrected accordingly. The wattmeter, speed recorder and dynamometer were kindly loaned for use during these tests by the railway department of the General Electric Company. The poles over the entire route were numbered, thus enabling the cars to be located with sufficient accuracy, and readings were taken, when necessary, at every pole, which was with sufficient frequency for the purpose. Whenever necessary the same motormen were used, and in every case men were chosen who had proved themselves to be reliable and steady operators. In the case of tests made during regular service, no select on of motormen was made.

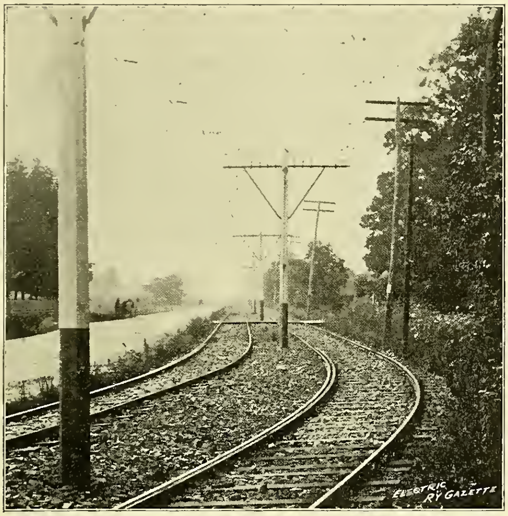


FIG. 4.—NEW TRACK AT THE 2.6 PER CENT. GRADE.

These tests were begun in the Spring of 1894 and continued at intervals until the Fall of 1895. For the conditions given the results can be taken as correct within a few per cent., but it must be borne in mind that for any other conditions the data cannot be considered as correct, though the difference may not be necessarily very great.

The Roads.

The roads on which the tests were made were principally the Pikesville Road of the Baltimore Traction Company, and the Roland Park Road of the Lake Roland Elevated Railway Company. Some minor tests were also made on other lines of the Baltimore Traction Company. The map, Fig. 1, shows the suburbs of Baltimore and all of the electric roads now in operation or in the course of construction. The heavier lines show the location of the roads on which the principal tests were made.

The Pikesville Road starts at the Retreat Street car barn in the northwest portion of the city, and runs along public and private roadways to Pikesville. The entire round trip is 13.66 miles, but the portion over which many of the tests were made, which excluded the loop, was 13.04 miles. About .7 mile (including the loop) is along paved city streets, and the remainder is along turnpikes and private or projected roads.

This road, which was started in July, 1892, was originally a single track with seven turnouts. The gauge is 5 feet 4½ inches, and on the old portion six-inch girder rails were used on the paved city streets, and on the turnpikes 56-lb. T-rails were laid on ties and filled in with dirt.

Figs. 2 and 3 show views of the old construction. Fig. 2 is looking toward Baltimore from the top of "Brown's Hill," the 5.96 per cent. grade on which many of the tests were made. The pole on the right is No. 34, and is at the junction of the Liberty Road with the Reisterstown Pike. Fig. 3 is looking toward Pikesville from near the "Pike Turnout" about two thirds of a mile below. Pole 293 (new number) is the nearest pole seen on the left.*

The new double-tracked portion is constructed more in accordance with modern steam railway practice, with 58-lb T-rails, on oak ties, 2 ft. 6 in. apart, laid on eight inches of stone ballast and filled in with stone. The curves were also increased in radius, made compound, and constructed to enable the car to run at full speed; many of the grades were also straightened. The track data has been plotted, and will be shown later, and on these diagrams the single and double track portion, the curves, poles, etc., can be readily seen. The overhead work consists mostly of single side and centre poles with iron brackets. No. 4 phosphor-bronze trolley wire is used.

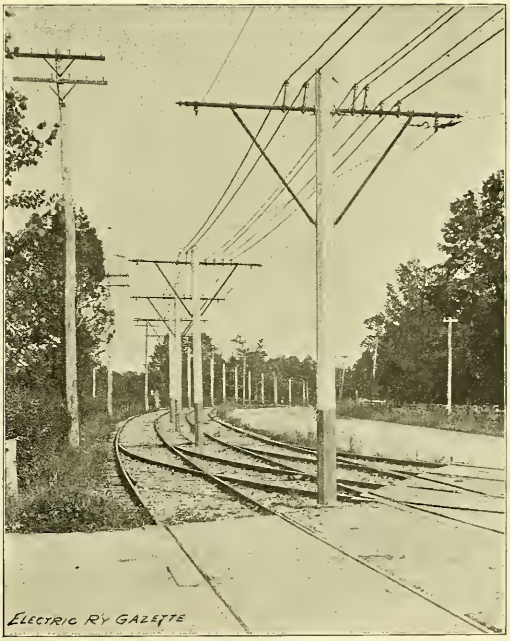


FIG. 5.—ARLINGTON JUNCTION.

Figs. 4 and 5 show views on the new double-tracked portion. Fig. 4 is the 2.6 per cent. grade on which many of the tests were made, and Fig. 5 the junction with the

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*These poles can be located on the diagrams of the roads, which will be given later.

Arlington Branch at Belvidere Avenue. In both views the style of construction is readily seen.

The nearest pole shown in Fig. 4 is No. 66 (new number), and in Fig. 5 is No. 154 (new number).

The travel on this road is entirely suburban. One fare is charged from Retreat Street to Belvidere Avenue, where the branch road runs to West Arlington, and another fare from there to Pikesville. The cars run at about 20-minute intervals in Summer and 30-minute intervals in Winter, extra cars being put on during Sundays and days during which races are held on any of the race tracks along the route. The time of the round trip varies from 1 hour to 1 hour 20 minutes, according to the schedule. The cars make from 13 to 18 trips a day, which is a mileage from 177.5 to 246 miles per car per day.

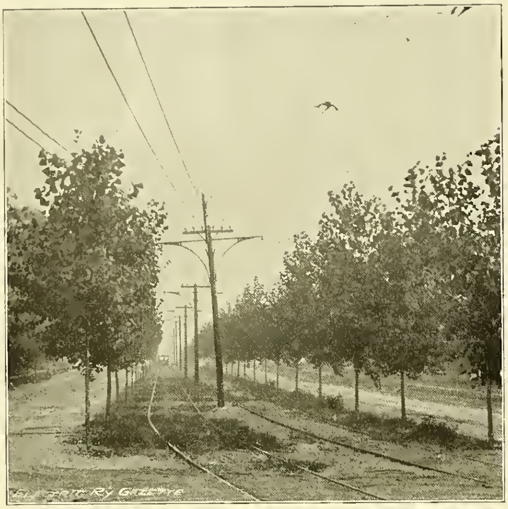

FIG 6.—NEAR ROLAND PARK.

The Roland Park Road starts at City Hall and runs northward, crossing the railways by means of an elevated structure .7 miles long, then follows stone paved city streets for 1.64 miles, and gravel-paved suburban streets 3.51 miles, and along its own private roadway 1.21 miles to its terminus at Lakeside Park, near Lake Roland. The distance from City Hall to Roland Park is 4.99 miles, and from Roland Park to Lakeside is 2.07 miles, making total of 7.06 miles. Counting the loop at Roland Park, which was not used during most of the tests, the regular round trip to Roland Park is 10.12 miles, and from there to Lakeside 4.28 miles. The road is double-track throughout its length. The gauge is 5 feet 4½ inches, and originally most of the road was laid with a new "duplex" rail, which, however, proved very unsatisfactory, and has largely been replaced with T and girder rails laid on ties filled in with gravel or else paved. Owing to the fact that the road runs through the city and along some narrow streets and has a zig-zag route in some parts, the curves are mostly very sharp and the grades irregular. Even in the strictly suburban portion of the route much of the track is very uneven, and high speed is prevented by the see-sawing of the cars. The Lakeside portion is laid better and enables a higher speed to be obtained. The overhead work is partly centre-pole and partly double side-pole construction. No. 0 hard-drawn copper trolley wire is used. Fig. 6 is a view near Roland Park, and shows the general character of the roadway and overhead construction. Fig. 7 is also a view near Roland Park, and shows the "duplex" and T-rail construction.

Fig. 8 is a view of the north approach to the elevated structure, which is about an 8 per cent. grade. A similar approach is situated at the southern end near the City Hall terminus. Fig. 9 is a view of the elevated structure from the Madison Street Station looking south. The general character of the construction and surroundings is clearly shown. Centre Street Station, where the car is stopping, can be seen, and also the dome of City Hall, and the tower of the Post Office Building.

This road carries some local city travel, but most of its passengers are from the suburbs, and are excursionists to the picnic grounds at Lakeside. Between Roland Park and City Hall the cars run at about 5-minute intervals, and between Roland Park and Lakeside, where an extra fare is charged, at from 5 to 20-minute intervals, according to the travel. The usual time of the round trip is about one hour, and between Roland Park and Lakeside, about 15 minutes. Between Roland Park and City Hall the cars make about 14 trips a day, which gives a mileage of 141.68 miles per car per day, and about 14 cars are usually operated; on the Lakeside extension the cars make about 37 trips a day, which is a mileage of 158.36 miles per car per day, and either one, two or three cars are operated, according to the travel.

Since these tests were made the Lake Roland Elevated Railway Company has been bought by the City & Suburban Railway Company and is now operated by them with some changes of route and schedule.

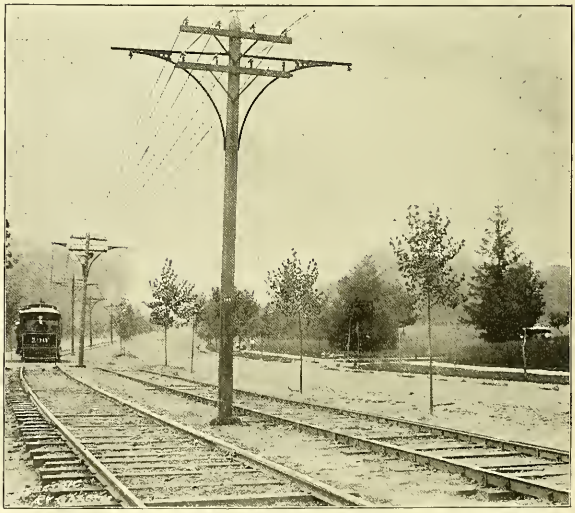

FIG. 7.—NEAR ROLAND PARK, SHOWING DUPLEX AND T-RAILS.

The other roads on which tests were made are various lines operated by the Baltimore Traction Company. These are lines that run through the heart of the city as well as through the residence portion and outskirts. They are shown in the map, and portions over which the tests were made are indicated by heavy lines. The tracks are laid with heavy girder rails on shoes and oak ties filled in with gravel and the roadway paved with Belgian blocks. Detailed data about the lengths, etc., of all of the roads are given in the tables containing the results of the tests.

Fig. 10 shows a typical down-town view, being the crossing of Baltimore and Charles streets, looking north on Charles Street. Cable and electric cars of the Baltimore City Passenger Railway Company run on Baltimore Street and electric cars of the Baltimore Traction Company on Charles Street. This crossing occurs in several of the diagrams containing speed records of the cars passing here, and the cause of frequent stops and slow speed will be readily seen.

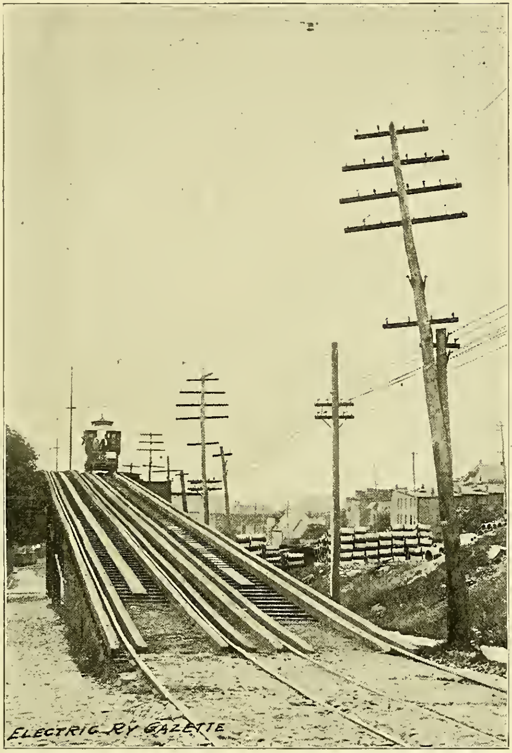

FIG. 8.—NORTH APPROACH TO ELEVATED STRUCTURE.

The various electric car lines operated in Baltimore and shown in the map aggregate a length of 254 miles of single track and operate about 600 cars, and the equipping of these roads has all taken place within the past two to four years. The extension into the suburbs is still continuing and some new roads are started every year. The following table shows the number of cars and mileage of each company as given by them:

TABLE I.

Names of Roads.	No. cars operated.	Miles single track.
Baltimore City Passenger Railway Company	112	53
Baltimore Traction Company	160	75
City & Suburban Railway Company	275	88
Pikesville, Reisterstown & Emery Grove Company	10	11
Baltimore & Middle River Railway Company	6	14
Central Passenger Railway Company	40	13
	603	254

The Car Equipments.

The cars of the Baltimore Traction Company are equipped with the Westinghouse apparatus, and those of the Lake Roland Company with Edison and General Electric apparatus. The car bodies of the Baltimore Traction Company are from 16 to 18 feet long and Bemis trucks are mostly used. The Lake Roland Company have some double and some single truck cars. The former were made by the Pullman Company, and have McGuire trucks equipped with No. 16 Edison motors, and the latter by Lewis & Fowler and have Lord Baltimore No. 2 trucks with General Electric "800" motors. Details concerning the cars used in the tests are given in subsequent tables. Both roads have open as well as closed cars, but those with which the tests were made were standard cars.

The Power Stations.

The power stations of the Baltimore Traction Company are located at Druid Hill Avenue and Retreat Street in the northwestern part of the city, and at Charles and Barre Streets in the central portion of the city, as shown in the map, each providing for the lines in their vicinity. There is also the power house operating the Curtis Bay road, located in Brooklyn, Baltimore County. The Retreat Street power house is back of and annexed to the Druid Hill Avenue cable power house. It contains two 250-hp Climax boilers, one 250-hp Westinghouse directly-coupled engine and generator, known as the "Kodak" type, running at 245 revolutions per minute, and one 250-hp McIntosh & Seymour tandem-compound engine, belted to a 250-hp General Electric four-pole generator, running at 535 revolutions per minute. In addition there are two 100-hp Ball engines belted to two 100-hp Edison dynamos, located in the cable power house, but they are only used in case of emergency.

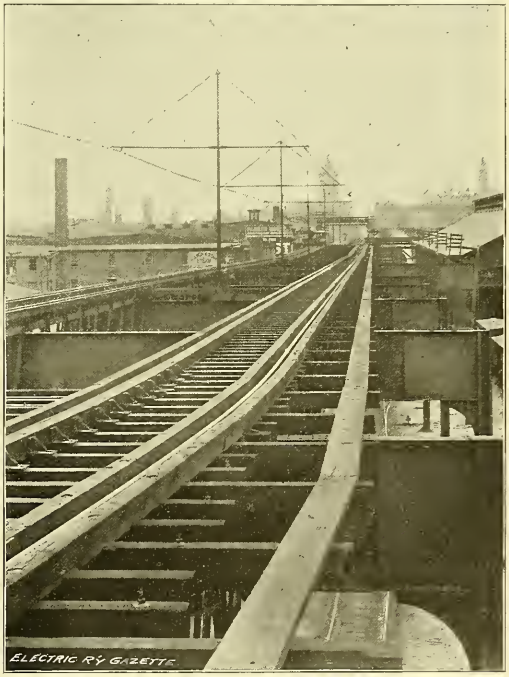

FIG. 9.—ELEVATED STRUCTURE FROM MADISON STREET STATION

The Charles Street power house contains two 500-hp and two 600-hp Climax boilers; and three 500-hp and two 250-hp directly-coupled Westinghouse engines and generators known as the "Kodak" type. These two stations, aggregating about 2,700 hp, provide all the power used by the electric lines of the Baltimore Traction Company, with the exception of the Curtis Bay road, which has its own power house at Brooklyn.

The power station of the Lake Roland Company is situated on Stony Run in the northern part of the city. It contains six Corliss boilers 200 hp each, two Corliss tandem-compound condensing engines 650 hp each, and one 400-hp Allis-Corliss tandem-compound condensing engine; five 400-hp General Electric four-pole generators, two belted to each of the larger engines and one to the smaller one; and there is also one 1,300-light Slattery alternator belted to a 150-hp Ball engine, used for furnishing lights at Roland and Lakeside parks.

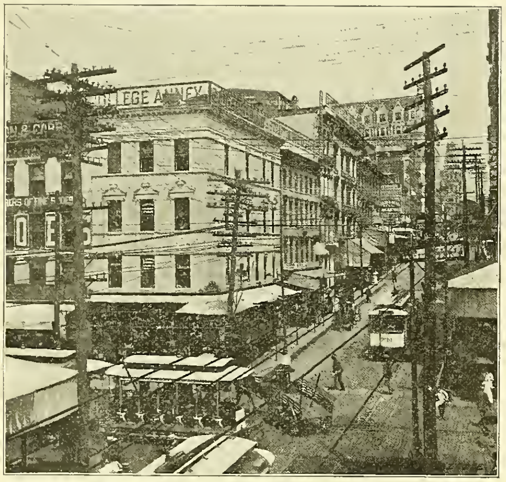

FIG. 10.—BALTIMORE AND CHARLES STREETS LOOKING NORTH ON LATTER STREET.

The power stations of all of the other electric roads in and around Baltimore are also shown on the map.

Enumeration of Tests.

Following is a list of the tests made:

1. Determination of the traction coefficient of the cars used in the tests.

2. Determination of the performance of the cars run over the entire car route, with no other cars on the road at the time:

(*a*) Pikesville road, 1893, single track.

(*b*) Pikesville road, 1894, partly double track.

(*c*) Lake Roland road, 1894, City Hall to Lakeside and return.

3. Determination of the performance of several different cars on uniform grades, at steady speeds and under various loads and controller positions.

4. Determination of the performance of the same cars run on both of the roads over the entire car route under similar and also under different conditions.

5. Determination of the performance of the same and other cars while running in regular service.

Tests were also made of the variation of watt-hours for the trip with the load, number of stops and character of acceleration; the losses in the trolley and rail contact; the pressure of trolleys on the wire, etc.; but these latter will be described in another series of articles as they are not as yet fully worked up.

(*To be continued.*)

Steam and Electric Lines.

It is interesting to note the effect of the electric line between St. Paul and Minneapolis upon the suburban business of the steam lines. This affords, perhaps, the best example of the power of the electric lines to control business. The distance between the two cities is about 10 miles, and is practically the same upon the electric and the steam roads. There were two steam roads operating trains at about half hour intervals (counting both roads) and the fare by commutation ticket was 15 cents. A single fare was 30 cents and a round trip 50 cents, and the time occupied upon the steam roads was 25 minutes between the terminals. Against this the electric line runs cars at six-minute intervals through the thoroughfares of both cities, stopping at any corner. They charge 10 cents for a trip and transfer to any connecting electric line. The time of the electric cars is 50 minutes, and yet the electric line takes the bulk of the business, with the result that a large proportion of the suburban trains upon the steam lines have been taken off. It is apparently safe, therefore, to predict that under similar circumstances the surface electric road will drive the steam road out of business, says the *Railway Review.*

There is another field in which the electric motor promises to be a complete success, and that is upon elevated railways, but the conditions in this case are so well known and understood as to make further comment unnecessary. It should be stated, however, that in point of cost it is reported that the fuel used per equal weight of train costs about one third as much upon the Metropolitan Elevated in Chicago as for the Manhattan Elevated of New York City, on which steam is used. It must be understood, however, that upon the elevated road anthracite coal is used, while the electric plant requires only a cheap grade of soft coal. The reports from the Baltimore & Ohio and the Nantasket Beach applications will also be interesting in this connection, for it is expected that the cost of operation will be less in both cases than when steam locomotives were used.

It is quite likely that a great many trunk lines will employ electric power upon branches and possibly also for suburban business, but those who are counting upon seeing the trunk lines themselves so operated in the near future will be disappointed. Branch lines can be improved as feeders by running light trains at frequent intervals, and where this can be done it is probable that business will be increased by running more frequent trains in cars that are adapted to such service. It is evident, however, that until there is a decided change in the running of through trains electricity will not be adopted for the handling of their traffic. It is not necessary to elaborate upon this statement more than to say that the varying conditions of traffic will be more economically met with the steam locomotives until such time as the train units for through traffic can be made small as well as the intervals between them.

Street Railway Engineers.—XVIII.

R. J. McCarty.

Few street railway engineers have been more successful in the management of street railway properties than Mr. R. J. McCarty, of Kansas City. Unless the writer is mistaken, Mr. McCarty has more than once carried off the banner for the economical operation of a cable railway. His record in this respect in Kansas City excited the admiration, if not the envy, of more than one manager of a similar railway in the country.

R. J. McCARTY.

Mr. Richard Justin McCarty was born in Virginia, on the twelfth day of March, 1851. His ancestors came over with Lord Baltimore, in 1633, and settled in Virginia, near the Potomac. His great grandfathers on both sides were soldiers in the war of the Revolution; his paternal great-grandfather served as colonel and participated in the battles of Brandywine, Trenton, and Germantown, and was present at the surrender of Lord Cornwallis at Yorktown. Mr. McCarty received his engineering education at the University of Virginia. From 1871 to 1875 he was engaged as engineer on the survey and construction of the lines of the International & Great Northern Railway in Texas. He then made Kansas City his home, and was for several years employed by the Kansas Rolling Mill Company, during which time he gained large practical experience in mechanical engineering. He then entered the service of the Kansas City, Fort Scott & Memphis Railway Company, where he remained seven years. In 1888 he was appointed general manager and chief engineer of the Metropolitan Street Railway Company, which owned and operated the largest system of street railways in Kansas City. This position he held until June, 1895, with great credit to himself and to the entire satisfaction of the company. During this time he had entire charge of the construction, operation and improvement of the large system of cable and electric lines of that company. In 1889 he constructed the first successful electric railway built in Kansas City, Mo. Mr. McCarty's experience as an engineer, combined with his thorough knowledge of the rigorous business methods and discipline of steam railways, enabled him greatly to improve the mechanical details of the system under his charge, and thoroughly to organize the business and to improve the discipline of the employees of the company. The operating expenses of the system when he took charge were about 14 cents per car mile run; this he succeeded in reducing to about eight cents, while at the same time he improved the service and kept the property in good condition. This was equivalent to a reduction in expenses of about $240,000 per annum. In 1888 the system barely paid interest on its fixed charges; since that year, however, the company has been paying dividends without interruption, earning from three per cent. to six per cent. over and above fixed charges every year, and this notwithstanding increasing competition and periods of financial depression.

In 1890 Mr. McCarty delivered an address before the American Street Railway Association, in convention at Buffalo, N. Y., in which he explained the relative merits of cable and electric traction, and from his experience with both systems was enabled to furnish statistics which constituted a valuable basis for comparison. This paper elicited wide and favorable comment and proved of great value to the street railway fraternity. At the succeeding convention the president of a large system of street railways made the statement that this paper had saved his company many thousands of dollars.

When the two large street railway systems of Kansas City were consolidated in June last and the presidents of the two assumed the positions of president and general manager, respectively, of the consolidated system, Mr. McCarty resigned his position and resumed the practice of his profession. He is now engaged in installing several electric light and power plants, and has charge of an extensive and complicated change in some of the cable and electric light plants of Kansas City, made necessary by the vacation of certain streets.

New Trolley Party Cars in Philadelphia.

The Philadelphia Traction Company has built four new cars for the use of trolley parties. They are reconstructed from the largest and best of the old cable cars, though little more than the frame of the old cars remain. They are 34 feet long and mounted on double trucks. They have an aisle in the middle and are provided with reversible cane seats. A bronze rail at the sides prevents accidents from persons leaning or falling out. There is no footboard at the side of the cars. The first of the cars was used Tuesday evening in carrying a trolley party composed of members of the Philadelphia Board of Surveys, who were guests of the company. The car which carried the party is named "Trilby" and the name is spelled out in lamps on the transom at each end. Its decorations are entirely of green and white lights, arranged on hangers of green and white China silk. There are more than 400 lights, inside and out.

Mexican Exposition Electric Railway.

An international exposition will be held in the City of Mexico in April, 1896. One of the concessions to be granted is a franchise for an electric railway to be constructed to the Exposition grounds.

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LIGHT RAILWAYS.

There has been an endless amount of discussion in England during the last year regarding light railways or narrow-gauge roads, cheaply built and designed to furnish transportation in farming districts. The Board of Trade some time ago appointed a committee to consider the matter, which recently reported that in Belgium 75 lines of this kind have been built with an aggregate mileage of 836 miles, and in Prussia 37 roads have been constructed with a mileage of 480 miles. It is reported that the lines are rendering excellent service in facilitating the transportation of produce of various kinds. On this side of the water the electric railway is likely to solve the light railway problem; in fact it is already doing so to a very considerable extent. In a report presented at the last convention of the American Street Railway Association it appeared that 55 companies were furnishing freight service regularly; six companies furnished special cars for this purpose, and 12 companies were considering the advisability of entering the business. Since then the operation of freight cars on the electric lines has become much more general. It is a noticeable fact that most of the new companies now formed to build roads in country districts propose to make the transportation of freight an important part of their business. Up to this time the farming communities which roads of this type are designed to serve have failed, apparently to a very considerable extent at least, to realize the advantages which will accrue to them from their construction. When they appreciate the importance which will follow the cheap and quick transportation of their produce, they will encourage much more liberally the building of these feeders, and the light railway problem will be solved.

ELECTRIC CAR TESTS.

We present in this issue the first of a series of articles embodying the results of a number of interesting and significant car tests made by Mr. Hermann S. Hering, associate in applied electricity in Johns Hopkins University, assisted by Messrs. Reutlinger and Branch, students in the Electrical Course in that institution. The information which it was the purpose of the investigation to secure relates in the most practical manner to the economical operation of electric railways. The data and conclusions are important, and will well repay the study of those engaged in electric traction work. The tests were instituted to determine the performance of electric cars of various kinds under definite conditions of load, speed, grade, track, etc., with a view to obtaining empirical data for these conditions which would have at least a fair degree of accuracy. The tests comprised: First, the determination of the traction coefficient of the cars used; second, the determination of cars run over an entire route with no other cars on the road at the time; third, the determination of the performance of several different cars on uniform grades at steady speeds, under various loads and with different positions of the controller; fourth, the determination of the performance of the same cars run on two different roads over the entire car route under similar and different conditions; fifth, the cars used for special tests were operated in regular service so that comparisons could be drawn. The result of operating cars on roads of radically different construction illustrates the advantage attending substantial roadway construction. Another interesting feature of the tests is the result of the operation of a car on a road before and after it had been double tracked and improved. The data are arranged in condensed but complete form in tables, and, so far as possible, plotted. These diagrams, many of which are quite elaborate, will bear careful study on the part of those wishing for details, and will yield information of an interesting character. It is a fact well worthy of notice that the electric railway companies afforded the fullest opportunities for making the tests, and they will gain substantial benefit from their cordial co-operation in this respect. Few companies, we believe, would permit even simple tests, to say nothing of encouraging such elaborate ones as those which we have outlined.

REDUCTION OF CAR SPEED.

The electric cars of Brooklyn do not at the present time provide rapid transit for the residents of that city. It is not easy to discover any great advantages that accrue either to them or to the companies from the operation of an electric railway system, to introduce and improve which millions of dollars have been expended. We present elsewhere in this issue a brief table furnished by the Brooklyn Heights Railway Company showing the time allowed by the existing schedule for trips on the several routes and also the time which was required by cars when they were drawn by horses. The showing is certainly a remarkable one and we question whether it can be equaled elsewhere in the country. It will be seen that at present not only do the electric cars make no faster time than the old horse cars, but in a number of instances the former take several minutes longer in arriving at their termini than was needed by the cars before the service was presumably improved by the introduction of electricity. It is almost unnecessary to remark that the company is not responsible for the continuance of the existing time schedules. They are formed in accordance with a municipal regulation whose provisions reduce the maximum speed in the central part of the city to six miles an hour and limit it to eight miles an hour in the outlying districts. By this ordinance the public is greatly inconvenienced, while the receipts of the company have been seriously affected. During the quarter which ended July 1, the Brooklyn Heights Company's gross earnings, compared with those of the corresponding period of the previous year, decreased almost $100,000, and its report showed a deficit instead of a surplus. This result, beyond all doubt, is to be attributed very largely to the fact that the company is no longer allowed to furnish a satisfactory service. As a matter of fact, the earnings should be greater than last year, as the city's population is increasing at a rapid rate, especially in the outlying districts, and extensions and new lines have been constructed to accommodate the new traffic in these sections of the city. It has been pertinently remarked that if the company, after receiving valuable franchise grants, had peremptorily refused to give better service than it afforded when horses were used it would be judged guilty of a breach of faith, and the fact would excite the bitterest kind of a public agitation; the authorities would be stirred to radical action, and it would be held to a strict account for the wretched way in which it discharged its duty toward the public. While the company is not responsible in the premises, but is only too ready to run its cars at a better speed, the people are just as seriously inconvenienced as if the blame could be laid at its doors. We shall be surprised if a public demand will not force the authorities to modify the existing arrangement. The ordinance was a piece of folly which commended itself to the aldermen as a measure calculated to punish the company for refusing to be dictated to by its men at the time of the strike of last winter, but the public is commencing to realize that it is being punished as well as the company. It is time that a change was made. Schedules reducing speed below that of out-of-date horse cars should be abolished in these days of progress.

Special Convention Train.

It is probable that a special train will be run from New York to Montreal to accommodate those who will attend the street railway convention. The train will probably leave New York on Monday evening, Oct. 14, and will arrive in Montreal the following morning. The convention will be called to order at noon on that day. The committee in charge has secured a concession of a fare and a third for the round trip.

Sixty-five-Mile Electric Railway.

The Detroit, Port Huron & St. Clair River Railway Company has been formed to construct an electric line which it is announced will be ultimately 65 miles in length. Among those interested in the project are Lester B. French and W. C. Maybury, of Detroit. W. H. Ashwell & Co., of Detroit, have already made the survey for a distance of 32 miles. The proposed line is projected for the purpose of giving transportation in the territory east of the Grand Trunk road from Detroit to Port Huron, thus affording communication with numerous St. Clair lake and river towns now without railway communication.

The project is an old one, but in its revived form electricity is proposed as the motive power for the road. It is stated that plans for financiering the concern have progressed to the point of signing preliminary contracts under which certain gentlemen have agreed to become stockholders in the company and take a specified number of its shares. A survey, which was begun within the last two months, was recently completed of 32 miles of territory which will form the midway link of the entire line.

Franchises have also been secured in all the townships and villages through which the projected road will pass. Contractors are now going over the line for the purpose of preparing estimates on excavation and other work, and contracts are expected to be let within a short time.

New York Street Railway Convention.

G. Tracy Rogers, president of the New York State Street Railway Association, announces that indications point to a large attendance at the annual convention in Albany, Sept. 17. Seven or eight of the smaller street railway companies in the State have recently joined the association, and applications for membership are being received daily. All supply houses are invited to send representatives, and space will be furnished for exhibits of material, small models, etc. A suite of rooms in the hotel will be provided for this purpose.

A feature of the convention will be the presentation of papers upon subjects of every-day importance to street railway men. All papers will be brief and concise, 15 minutes being the limit allotted to each one. The following is a list of the topics which it is proposed to consider in papers and discussions:

Points on financial organization.

Car mileage record. Its advantages.

Improvements needed in electric motors.

Suggestions for special track construction.

How can we increase travel, especially in smaller cities?

Are we laying too many miles of track to reach a few people?

Is selling tickets at reduced rates an advantage or disadvantage?

The maintenance of power-station from an economical standpoint.

How to keep car-bodies clean? A plan for daily inspection and care.

Fenders—Are they practicable? Their advantages and disadvantages.

Is a freight or mail service profitable or unprofitable on street railways?

The use and abuse of transfers, and are they advantageous in smaller cities?

Overhead construction; maintenance of same, and suggestions for new work.

How can we prevent accidents and increase the general efficiency of employees?

How shall we heat cars? The relative cost and advantages of electricity and stoves.

General track construction and the most approved method. Suggestions for improvement.

How to prevent collusion on the part of motormen and conductors to defraud the company?

The best method of and the advantages gained by rotating crews and distribution of runs.

The relative advantages and disadvantages of single and double tracks for interurban service.

Can small electric roads be operated to advantage in conjunction with small electric light companies?

Report blanks, time sheets, etc., and their general usefulness to the superintendent. Suggestions for forms.

The daily inspection and care of car equipments. How to accomplish the best results with the least expense.

The daily record-book of conductors' returns—its necessity and advantages. Suggestions for headings.

The best method of promoting personal interest on the part of the employees in the affairs of the company.

Signals and inter-communication with reference to maintenance of schedule on single-track street railways.

The proper form of liability insurance. Can a company insure themselves to advantage by establishing a fund?

What is the proper and most efficient method of protecting a street railway company from dishonesty of employees?

Street car wheels—should they be made heavier, to avert possibilities of accident? Is it possible to establish a standard?

Street railway legislation—how can it be met to best subserve the interests of street railway companies and the public?

The comparative advantages and disadvantages of operating long or short cars. The extra expense and increased capacity considered.

How shall we prevent pounding down of track joints? How shall we remedy the evil, when it exists, without replacing entire track?

Power from the trolley circuit. Is it practicable? Why do fire insurance companies object? What should be done to overcome the objection?

Pleasure resorts and their advantages to street railways. Are they profitable? How should they be conducted and maintained to attract the largest number of people and secure permanency?

Can cities of less than 15,000 inhabitants support a street railway of moderate mileage, carefully and well built at present prices, without over-capitalization of costs, owned and handled by local parties? What measure of profit can be expected therefrom?

Speed of Electric Cars in Brooklyn.

A recent change in the time schedules of the Brooklyn Heights Railway Company led to the report that the company was violating the municipal ordinance which limits the speed of electric cars to six miles an hour in the central part of the city and to eight miles in the outlying districts. This report was found to be incorrect. President Rossiter, of the Brooklyn Heights, has furnished a table showing the time allowed cars in making their runs, with comparisons of the time allowed under the schedule when cars were operated by horses. It appears that the present speed on about half the lines is materially less than when the cars were drawn by horses. The showing would seem to justify the remark of President Rossiter, that "the introduction of electricity cannot bring to Brooklyn any more rapid transit than was allowed under the old horse-car system so long as the present speed ordinance continues." The table is as follows:

	Horse car schedule.	Original electric schedule.	Present schedule.
Greenpoint	54	48	58.0
Lorimer Street	54	48	58.0
Flushing Avenue	25	21	29.0
Crosstown	73	57	71.2
Bushwick Avenue	40	30	38.2
Union Avenue, via Metropolitan	40	30	38.2
Myrtle Avenue	46	38	48.2
Gates Avenue	48	46	51.0
Nassau Avenue	..	15	18.2
Grand Street	39	32	36.0
Tompkins Avenue	32	25	31.2
Hamilton Avenue	..	30	32.0
Nostrand Avenue	46	35	39.2
Fulton Street	53	46	49.2
Flatbush	45	38	52.0
Third Avenue	..	58	60.0
Putnam Avenue	44	39	45.0
Court Street	23	21	23.2

Sale of Syracuse Consolidated.

The Consolidated Railway of Syracuse has been purchased by the Syracuse Street Railway Company. The road was recently sold at auction and was bought by Frederick Strauss, of New York, who represented the majority of the bondholders, the price being $835,000. About 31 miles of street railway is included in the consolidated system. The negotiations for the sale of the property were conducted in New York, and were participated in by W. W. Hazard, of Cleveland, president of the Syracuse Railway Company; Vice-President W. R. Kimball, of Syracuse; Treasurer T. H. Conderman, of Philadelphia, and representatives of the owners of the Consolidated Railway.

It is announced that the purchase of the railway means the unification of all the street car roads of the city, a general system of transfers, and one fare of five cents from any part of the city to any other part. In reference to the purchase a local paper says: "It seems a wise transaction on the part of the two companies, as no one believes that the Consolidated system could have been operated at a profit, inasmuch as many of the Syracuse Company's lines were parallel with the Consolidated tracks. On the other hand, the Syracuse Company is benefited, because it now has the entire system of the town under its control and may abandon lines which are useless, both from railway and from a public-serving standpoint, which it will undoubtedly do.

Prevention of Electrolysis of Burned Pipes.

Last year I. H. Farnham read before the American Institute of Electrical Engineers an interesting paper on the "Destructive Effect of Electric Currents on Subterranean Metal Pipes." The paper, which excited considerable interest, was published in the GAZETTE at the time. In a recent number of *Cassier's Magazine* Mr. Farnham points out errors which appear to exist in the minds of some and describes a new method for minimizing the danger of electrolysis. The first error is the belief that careful bonding of the rails will prove a sufficient remedy; while good bonding is of great importance, no amount of it will wholly prevent portions of the current from passing through the pipes; he cites an illustration in which an underground telephone cable was destroyed when the voltage between the pipe and the earth was only 0.5 volts. The second error lies in the suggestion of connecting the pipes with the rails at frequent intervals; this reduces the action in the district near the power station and increases it in other portions of the city; it would cause currents to leave the pipes in localities distant from the power house, returning to them again near the source of power. A third error is in the assumption that the danger exists only in large cities or where the construction is bad; he shows iron pipes destroyed in a small city where not more than six cars are run at a time; the return copper wire used in Boston is said to amount to 70 per cent. of that of the outgoing conductors, but, notwithstanding this, a current of 500 amperes is taken from the lead covering of telephone cables near the principal power house, which shows that good construction is not sufficient. Another error is in the belief that it is impossible to find whether corrosion is due to the current of water, or whether it is simply chemical; for practical purposes it is possible to determine with certainty whether a pipe is being electrolized by merely taking voltage measurements between the pipe and the damp earth surrounding it; when the pipe is positive to the earth, electrolysis is sure to result; the voltmeter is much better than the ammeter for this purpose. In all cities in which the single trolley system is used the earth in one section has a different electrical condition from that in other sections; he found differences reaching 50 volts or more. He then describes his method for minimizing the danger; it will also preserve the tracks from electrolytic action. The principle of his system is to preserve a balance in the electrical condition throughout the city, for if there is a balance there is no disposition for a current to flow; the method consists in extending from the negative or rail side of the dynamo an insulated return wire throughout the entire length of the railway and make it of such size as to properly carry the current, maintaining the return path at a comparatively low resistance; from this wire frequent connections are made with the track, say one at every other pole, the connections being of such a size as to keep the resistance from the rail at the nearest point to the power house, the same as that from the most distant rail connection to the power house; no ground connections are allowed on the dynamos; the rails must of course be suitably bonded; perfect results cannot be reached by this plan, but to adopt it he believes is certainly going in the right direction.

"This system of returning the railway current," says Mr. Farnham, "will accomplish several desirable ends: 1. It will allow but very little current to enter the earth and flow therein. 2. The current through the earth being minimized, electrolysis will to that extent be prevented. 3. Having by this means reduced the danger of electrolysis to small proportions, it will be comparatively easy to take care of the remaining danger, if such be found, by resorting to the means described in the previous paper. 4. In addition to practically overcoming the danger of electrolysis, the annoyance to telegraph, telephone, burglar alarm and other grounded circuits, due to difference of potential in different sections of the city will be incidentally removed.

"The equi-potential return system just described has so far been tried in a New England city as to indicate practically that the benefits claimed for it may be confidently expected. There are no patents which will interfere, as the writer understands it, with the use of either system here referred to or described, for preventing electrolysis of underground pipes and other metal bodies. Railways, cities and corporations are at liberty to avail themselves of the results of many experiments, tests and practical experience briefly referred to here."

Tramways in India.

When the question of starting such a democratic institution as tramways in such an aristocratic country as India, as far as the white population is concerned, was first mooted, it was argued by men fairly conversant with the requirements of the country that it would prove a failure, as the sole users of the cars would be natives, and among them caste would render impossible that close contact of persons so often inseparable from street railway riding. But other men, who looked more deeply into the question, and did not shut their eyes to what had happened in the railways of India as regards caste, took the opposite view, and the success which has already been achieved by the Bombay tramways has disproved the pessimists' opinion. A recent tour, embracing all the towns in India in which tramways have been started, afforded me an opportunity to observe the progress which is being made, writes a contributor in the *Railway World*, of London. Touching first at Colombo. the . chief port of Ceylon, I was struck by the immense amount of the movement of population, which is mostly met by a very interesting and recently introduced Japanese institution, called the jinrickshaw or 'rickshaw, which is a light miniature two-wheeled dog-cart seated for one, the tractive power of which is a human being. While this afforded me a pleasant and novel means of transport, I felt that having a human animal between the shafts was painful, a feeling that was intensified on learning that the work, although remunerative to the "horse," was, like tramway service, killing in its effects, and that the lives of the poor propellers are short, though perhaps merry ones. It was, consequently, with relief that I learned that a concession had been claimed, if not yet officially granted, to a company to lay down a system of tramways in Colombo, electric power being the proposed method of traction. Besides the financial advantage, there is also a great incentive to the improvement in the convenience it would afford to the public, and the removal of what at present constitutes a blot upon humanity, *i. e.*, the human "horse." It may be remarked that if the tramways are worked by electricity, a supply is also to be produced for the purpose of light.

The next point visited was Madras, the capital city of what is known as "the benighted Presidency." Here a considerable system has been laid down by the Electric Construction Company, London and Wolverhampton, and the electricity is carried for a mile or two through an underground conduit, the slot in the roadbed affording communication between the electric conductor and car motor, being ingeniously arranged to act as the groove of one of the rails. In my opinion great difficulty will be experienced in working a conduit system in such a climate and locality, as in dry weather it is sure to be choked by dust, and in the rains, which are torrential in their character in Madras, it is equally sure to be flooded, no matter what drainage be provided, and the insulation of the wires rendered ineffective. At the time of my visit cars had not commenced to work upon it, but the native mind had, and seemed to be deriving great satisfaction from packing up the slot and conduit tightly with hoop iron, dust and debris, which made one think that in Madras, at least, electricity should be solely conducted overhead.

Calcutta was the next point of arrival. Here a very complete system of 20 miles of tramways, worked partly by steam and partly by horse, is most efficiently managed by Mr. J. R. Maples. But here in a country where horses are comparatively cheap, and forage abnormally so, the use of the steam engine has been found an economical mistake, and there is reason to believe that its use is only being continued because the steam plant has been provided, and cannot, at least for the present, be dispensed with. The horse stud numbers over 1,000 animals, the average cost of feeding being under three rupees, or at the present rate of exchange, about three shillings and fourpence in sterling per week ; but as profits have to be remitted to this country at the same rate the result of cheap feeding is almost nullified to the shareholders.

Most elaborate and humane arrangements have been perfected by the manager to mitigate the effects of the hot climate on the stud. I was particularly impressed with the complete arrangements of all the stables—which have been totally remodelled since delivered by the contractors—to secure air, shade, ventilation and sanitation, the building being constructed for the most part of old rails, with roofs of corrugated iron. There is also a very good arrangement of daks or rest-house stables, which are simply shady and airy sheds, situated here and there on the main routes, into which the horses are led for rest and coolness.

At Lahore I saw what may be termed an innocent tramway, which was "one horse" in every sense of the word. The police regulations against overcrowding are practically non-existent there; and the natives may be seen clinging like bees to the vehicle, making the occupation of the one horse in question anything but a sinecure. But Lahore, the capital of the Punjaub and the seat of government of the Northwest Provinces, is a fine city, and is fast becoming the most important in the north of India. It is inhabited by a much more stalwart race of men than the Bengali, and their tramway system will no doubt develop into one of some importance, and is noticed here more particularly from the point of view of the future.

Karachi was the next town of importance reached, and here a very elaborate system of tramways has been laid down by the East India Tramways Company, which is under the management of Mr. J. Forest Brunton.

Comments and Views of Contemporaries.

To Decrease Accidents.—Nothing but the adoption of an adequate fender and the employment of motormen with good judgment will decrease the loss of life on the trolley lines. The fender must run close to the tracks, it must remain at a fixed distance from the rails, and it must guard the wheels so that neither an adult nor a child can roll under the car from the side. It is bad enough to kill people by knocking them down, but the horror is increased when the car wheels run over them. If the first blow does not kill them the victim is sure to be fatally injured when he gets under the wheels. The city authorities should insist upon a fender that will make it impossible for even a child to be crushed by the wheels.—*Brooklyn Eagle.*

Electric Locomotives.—The most significant movement in favor of electric motors is the reported alliance of the Baldwin Locomotive Works and the Westinghouse Electric Company. This partnership is for the purpose of constructing electric locomotives and electric motive power equipment. It may be, and probably is, true that the only thing now contemplated is a union of forces, each plant being employed for that division of the work for which it is best suited, but partnership would not have been thought of, much less arranged, if the shrewd business men at the head of both concerns had not foreseen a great increase in the demand for electric motors of considerable power, which demand they can best supply by working together.—*Philadelphia Ledger.*

Rapid Traveling.—The breaking of railway records is interesting, because it shows what we are coming to. We shall have electric engines presently that will distance the steam locomotives, and avoid the dust and clatter of the present mode of passage. It is said that electric trains can be speeded to 100 miles an hour—a pace already reached by the famous engine No. 999 of the New York Central road—but that will not be practicable without a perfect roadbed and the abolition of grade crossings. With a trolley system lighter trains can be run, because they can be run at more frequent intervals, it being just as easy to keep 15 trains going as to keep one. The world is moving pretty fast in these days, but it has not reached the pace that satisfies.—*Brooklyn Eagle.*

Suburban Electric Express Trains.—It has been suggested that where a line of suburban railway service was equipped with electricity it would be possible to run express trains outward to each station by having a car dropped at each station as the car proceeded, permitting each of these to come on afterward on its own account, from the station where it stopped to the end of the suburban route, as an accommodation car. In the same way single cars could be run inward at frequent intervals, stopping at only part of the stations. In fact, it does not appear unlikely that if an electric system were thus employed, the patrons of a road would obtain all the advantages of speed that they now secure through steam, with a much more frequent car service.—*Boston Herald.*

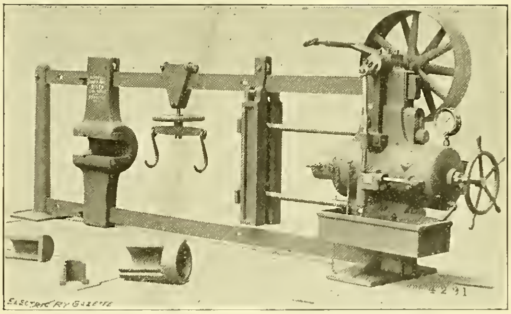
The Small Boy and Electric Cars.—It is a favorite pastime for the gamins of the street, in the evening, to play pranks with the electric cars. They jump on whenever the conductor is engaged so that he cannot see them, and jump off again whenever they are in danger of detection. This is all done whenever the cars are in motion, with imminent danger of slipping or falling, and the escapes from instant death have been numerous. Neither the conductor nor the motorman can put a stop to this diversion, and if it continues, what seems to the boys like a harmless amusement will result in some fearful and tragic deaths, for which the parties in charge are not responsible. If there were a law that could be enforced for the arrest and punishment of these boys whenever they undertake to play hide and seek on the electric cars, it would save a great deal of trouble by way of deterrence. *—Boston Herald.*

English View of Lenox Avenue Conduit Railway.—Altogether, we cannot see that any great step forward has been made, and we are of the opinion that the trolley system is not likely to be extensively affected until some more radical improvement has been made than is shown by the New York installation. Where a conduit of such high cost can be supported, it is difficult to see where electric traction can have a greater value than the cable. Moreover, we are strongly of the opinion that a properly constructed overhead line of conductors with ornamental poles and taut wires, is less disadvantageous even in city service than a system which involves the tearing up of a large part of the street surface during construction, with the attendant probability of extensive interference with gas, water, sewage, electric light, etc. The overhead line possesses the great advantage of enabling a mechanically propelled traction system to be installed with comparatively little interference with the roadway, and it remains always independent of the roadway, so far as operation, repairs or reconstruction are concerned. It has also the advantage that its cost is within reach of any tramway operated by animal power upon a fairly large scale, and it has demonstrated its ability to effect a substantial reduction in the operating expenses of such tramways, while at the same time greatly adding to the public convenience. The conduit system has one advantage only in its favor, namely, that it dispenses with the use of elevated wires, and it would seem to us that the price paid for that problematical advantage is, so far, much too high.*—London Electrical Review.*

The Rise in Copper.—The remarkable advance in the local copper shares at the present time, which has grown to enormous proportions, is one of the most pronounced speculative movements that the local market has known for years. It reflects in a surprising manner the returning prosperity that is now being felt all over our country. Beyond this, however, it comes as a readjustment of values on a new and higher level as the outgrowth of a demand for copper that is unprecedented. It is because of this fact that the ordinary rules and theories of speculation do not apply and that what seems to be a "craze" is really the natural outcome of new conditions. With the ending of the long period of business depression and financial disaster, there came fresh ventures in the line of electrical development. This new field, calling for an enormous amount of copper, even before the new era of prosperity had set in, immediately increased the demand at a rapid rate. With the extension of the electric street railway system and the increasing work of substituting electricity for steam, together with the recent enlargement of the telephone service, the call for copper came to the producers in a way that they were not expecting. And so, within a short time, they had not only cleaned up their stocks in hand, but had sold several months ahead, and the price of ingot had advanced from 9 to 11¾ cents. The present price is not in itself comparatively high, but the rapidity with which the advance has been made is something that has rarely been paralleled. When it is taken into account that every small fraction of a cent in the price of copper means an added revenue of thousands of dollars to every large producer, and that added revenue is precedent to increased dividends, it is easy to understand why copper shares have developed such a "boom." The best and most substantial feature of this whole movement lies in the fact that although the demand for copper has grown to such enormous proportions, the producers here and abroad and in Chili are not in a position to quickly increase their production. There are, undoubtedly, mountains of undeveloped copper within the limits of our own country, but the lack of transportation and mining facilities render them unavailing to meet the present wants. *—Exchange.*

One Hundred-Ton Hydrostatic Press.

The accompanying cut illustrates a special 100-ton hydrostatic press especially designed for electric street railway purposes. The special resistance part, it must be noted, is onto the top bar, an arrangement made so as to facilitate the removal of pinions or other parts from shafts when the standard resistance part is too wide. Two vertical bars are hooked on the trolley that travels on top of the rail, so that the bars can be quickly removed. The bar is supported by two heavy forged bolts that are attached to the fixed head, and are adjustable vertically so that they can be brought close together. The press is made by the Niles Tool Works, of Hamilton, O.



ONE HUNDRED-TON ELECTROSTATIC PRESS.

To Enjoin Payment of Principal and Interest.

An application has been made to Judge Stover in the Supreme Court in New York for a writ restraining the New Orleans Traction Company and J. & W. Seligman from paying the interest or principal of certain notes aggregating $130,000, made under direction of the board of directors of the company in November last. In February, 1894, the Seligmans and the Hollins Company entered into an agreement. The former held large ownings in the New Orleans Traction Company. Hollins & Co. were asked to form a syndicate and raise $3,000,000, in return for which the Seligmans were to give the firm 7,500 shares of New Orleans Traction stock valued at $130,000. The present legal proceeding concerns the validity of the issue of stock.

FINANCIAL NOTES.

CLARKSVILLE, TENN.—Subscriptions to the stock of a company to build an electric railway in Clarksville have been asked for.

CONSOLIDATION TALK IN ST. LOUIS.—A press dispatch from St. Louis states that street railway men in that city no longer deny that they are perfecting arrangements for a consolidation. It will take a capitalization of at least $50,000,000 to absorb the traction interests.

ROCHESTER (N. Y.) RAILWAY.—The report of the Rochester (N. Y.) Railway Company, for the quarter ending June 30, 1895, gives the following figures: Gross earnings from operation, $220,167.02; 1894, $179,969; operating expenses, $127,096; 1894, $104,042; net earnings from operation, $93,070; 1894, $75,926; gross income from all sources, $94,606; 1894, $77,876.

TO BUY THE LANSING RAILWAY.—It is announced that Major Downs, of New York; E. E. Downs, of Battle Creek, and F. N. Rowley, of Kalamazoo, builders and operators of street railway lines in Battle Creek and Kalamazoo, have secured options on the Lansing City Street Railway, of Lansing, Mich., and it is said will buy that property. They represent a syndicate of Boston and New York capitalists.

DENVER RAILWAY SALE POSTPONED.—The Denver City Cable Rail way Company's property was not sold under foreclosure Aug. 22 as announced, on account of the inability of the New York men interested, Messrs. Taintor and Holt, and others, to attend. The sale was postponed to Sept. 10. An offer of $1,000,000 would have been made for the property, but the holders of the $1,000,000 floating debt will try to put through a reorganization plan so as not to be left without anything.

PHILADELPHIA HESTONVILLE EARNINGS.—The earnings of the Hestonville, Fairmount & Mantua Passenger Railway Company for the first 25 days of August aggregated $35,000, or $18,622 more than for the same period last year. The total number of passengers carried in the first 24 days of August was 704,256, an increase over the same period last year of 336,424 ; for the seven months ended July 31 the company carried 6,213,981 passengers, an increase over the corresponding period of 1894 of 2,550,609 passengers.

NO SIGNIFICANCE IN THE VISIT.—The visit of Messrs. Widener and Huhn, of Philadelphia, in Chicago, at this time, when they might naturally be expected at the seashore, has occasioned some talk in financial circles. It is announced, however, that no financial project was contemplated. and, according to a Chicago paper, they made the visit merely "to look over their interests in the city, though it was reported that they were also looking into the feasibility of a possible future consolidation of all the surface railway companies of Chicago."

BROOKLYN HEIGHTS QUARTERLY REPORT.—The following figures are taken from the report of the Brooklyn Heights Railway Company for the quarter ending April 30: Gross earnings for quarter, 1895, $1,086,083; 1894, $1,183,741; operating expenses, 1895, $736,201; 1894, $725,883; net earnings from operation, 1895, $349,881; 1894, $457,858; income from other sources, 1895, $59,852, 1894, $56,063; gross earnings, from all sources, 1895, $409,734; 1894, $513,921; interest, rentals, insurance and taxes, 1895, $540,863; 1894, $496,686; deficit for quarter, 1895, $131,129; 1894, surplus, $17,235.

SALE OF ST. JOSEPH (MO.) LINES. –The St. Joseph street railway lines, together with all the rolling stock, real estate, and other property used in their operation, and all the property of the St. Joseph Traction & Lighting Company, were sold at public auction Aug. 21, and were bid in by E. A. Noyes, of Portland, Me., and Edward P. Harrigan, of New York, purchasing trustees of the stockholders of the company, for $300,000, which was the lowest bid that could be accepted under order of the court. The sale was made to satisfy a mortgage held by the Central Trust Company, of New York.

BROOKLYN & NEWTOWN QUARTERLY REPORT.—The following figures appear in the report of the Brooklyn City & Newtown Railway Company for the quarter ending June 30: Gross earnings 1895, $158,242; 1894, $157,859; operating expenses, 1895, $100,649, 1894, $72,584; net earnings, 1895, $57,593, 1894, $85,275; other income, 1895, $246; gross income, 1895, $57,839, 1894, $85,275; fixed charges, 1895, $31,688, 1894, $29,837; net income, 1895, $26,151, 1894, $55,438. The general balance sheet shows assets of $3,454,775, including $3,256,555, cost of road and equipment; $96,711, accrued interest, and $66,505, cash on hand. The capital stock is $1,000,000; funded debt, $1,960,000 ; interest on funded debt, due and accrued, $49,000, and profit and loss, surplus, $223,040.

PROPOSED CONSOLIDATION IN SEATTLE.—The Consumers Electric Company has been incorporated. The organization of the company was decided upon in order to effect a separation of the electric light plant and the street car plant of the Third Street & Suburban Company. The incorporators are Thomas Boyd, A. M. Brookes and W. J. Grambs. The old corporation, in addition to the electric light and street car properties, owns the Western mill, but in a few days transfers will be made to the new company of all but the street car line and its equipment. When this step has been taken another obstacle will have been removed from the plan of consolidating into one system the street car lines of Seattle. Street car operators state that the only salvation of Seattle properties is in consolidation, whereby there will be effected a material reduction of expenses. It is claimed that the public would be greatly benefited, through a complete system of transfers and greatly improved service.

BROOKLYN HEIGHTS RAILWAY.—It is stated that the action of President Rossiter, of the Brooklyn Heights Railway Company, in signing an agreement by which the men who left their positions during the strike of last Winter were to be given preference when they made application for employment, has excited some discussion among the stockholders of the company The Brooklyn *Eagle* says: "When Mr. Rossiter consented, about two weeks ago, to meet and treat with the representatives of the ex-employees of the railway company, nearly every one who had any financial interest in the Brooklyn Heights railway system expressed their disapproval in terms of more or less strength. They had been informed by the previous management that the hands of the labor organization were gripping so tightly about the throat of the railway that it was being slowly strangled. That at no matter what cost the Knights of Labor must be defeated, and that in the end it would prove profitable, No less important a personage than John G. Jenkins said it would increase the revenue of the railway a quarter of a million dollars a year if it could be run as its directors thought best and not in accordance with the dictates of the labor committees. Those same people had passed through the experience of having the company spend half a million dollars to win the strike and were expecting soon to get the benefits promised. It is no wonder then that they did not approve Mr. Rossiter's action in even admitting that there was such an organization as the Knights of Labor."

NEW INCORPORATIONS.

CLEVELAND, O.—Articles of incorporation of the Wooster, Medica & Cleveland Street Railway Company were filed at Columbus, Aug. 21. The main office of the company is to be at Wooster. The incorporators are L. P. Ohliger, J. R. Zimmerman, A. Cunningham, C. V. Hard and others.

THE KANSAS & ARKANSAS CONSTRUCTION COMPANY, Kansas City, Kan., has been formed to erect buildings, electric light and gas plants, and to build and equip railways. Those interested in the project are W. W. Atkins, B. L. Short, C. A. Ellis, J. J. Spencer, Kansas City, Kan. Capital stock, $50,000.

THE FORT WAYNE, LAKE EVERETT & COLUMBIA CITY STREET RAILWAY COMPANY, Fort Wayne, Ind., has been incorporated by Charles E. Everett, Wallace Dowd and William Geake, for the purpose of building, equipping and operating an electric street railway in Fort Wayne. Capital stock $300,000.

THE BRYAN, HICKSVILLE, MAYVILLE & FORT WAYNE RAILWAY COMPANY, Hicksville, Ohio, capital stock $50,000, has been organized for the purpose of building and operating an electric railway in Williams and Defiance counties, Ohio, and Allen County, Ind. Those interested in the project are F. W. Horton, C. F. Swift, J. B. Colegrove, W. G. Deastman, John W. Winn, George C. Serrill, John S. Hart, M. M. Hootman, W. H. Harter, J. J. Dorsey and R. M. Simmons.

NEWS OF THE WEEK.

YOUNGSTOWN, O.—The contract for building the electric railway from Youngstown to North Lima has been awarded.

LITTLE ROCK, ARK.—The Boulevard Street Railway Company, of which J. H. Healey is manager, has been granted a franchise.

DETROIT, MICH.—The rule providing that cars shall stop at the first crossing at street intersections went into effect last Sunday.

HICKSVILLE, O.—Eastern capitalists are said to be considering a project to build an electric railway from Bryan, O., to Fort Wayne, Ind.

AUBURN, N. Y.—The Auburn City Railway Company made an application for a new franchise this week. The hearing will take place Sept. 6.

MILLBURY, MASS.—Millbury and Sutton have granted a franchise to the Blackstone Valley Electric Railway, and Grafton will probably do likewise.

PHILADELPHIA, PA.—The Association of Electric Car Workers gave a trolley party Aug. 29. Forty cars were in line, every fifth one being illuminated.

DEDHAM, MASS.—A new electric railway is to be built from Dedham to Walpole by way of Norwood, to be known as the Norfolk County Electric Street Railway.

NEW ORLEANS, LA.—The Hudson Street Railway franchises, numbering six lines and covering the entire city, have been sold for $10,000, the bidder being James J. McLoughlin.

NIAGARA FALLS, N. Y.—Surveys are being made for an electric railway from Niagara Falls to Rochester, passing through Gasport and reaching the Ridge road near Johnson's Creek.

BLOOMSBURG, PA.—A plan is on foot to connect Danville and Bloomsburg with an electric railway. The company is made up of Danville men, and is said to be backed by Allentown capitalists.

PHILADELPHIA, PA.—A motorman in the employ of the Philadelphia Traction Company was killed on Aug. 28. He jumped from a car and was struck by a Hestonville car going in the opposite direction.

BALTIMORE, MD.—Those interested in the Richmond Traction Company which proposes to operate an electric railway in the streets of Richmond, including Broad Street, announce that 13 miles of track will be laid.

GRAHAM, VA.—The Graham-Bluefield Electric Railway Company, in which A. St. Clair, D. E. Johnston, T. H. Graham and others are interested, is considering the construction of an electric railway at a cost of $50,000.

SHAMOKIN, PA.—The Schuylkill Traction Company and the Shamokin & Mount Carmel Electric Railway Company will build a connecting line from Ashland to Centralia, and then there will be a complete line from Shamokin to Mahanoy City.

FORT WAYNE, IND.—The electric railway from this city to Lake Everett is practically assured, as the commissioners have granted Mr. Everett a franchise; work on the road must begin within 90 days, and the road be in operation within a year.

DETROIT, MICH.—The Detroit Railway has increased its working force so as to complete as soon as possible the work on its new lines. Some 40 miles of track yet remains to be completed before Jan. 1, and the greater part of the work must be done within the next 90 days.

CHICAGO, ILL.—The preliminary work on the southwestern branch of the Metropolitan Elevated is now well under way. Considerable property needed for the right of way has already been purchased, and as soon as the courts reconvene a number of condemnation suits will be commenced.

LOGAN, UTAH. -The Hercules Electric Power Company proposes to install an electric light plant and construct an electric railway. Theodore A. Davis is to be manager of the company. Hon. L. L. Nunn, of Colorado, is at the head of the enterprise. The company will obtain its power from the Logan River.

FALL RIVER, MASS.—The Fall River Street Railway Company, at meeting of stockholders, held recently, elected the following officers : President, Wendell E. Turner ; treasurer, John T. Robertson ; clerk of corporation, James F. Jackson. The work of constructing the road will begin next month.

SAGINAW, MICH.—The township board of Carrollton has granted the Saginaw & Bay City Rapid Transit Company a right of way through the township. The right of way has already been secured through Kochville and Frankenlust. One of the conditions of the right of way is that work must commence within 30 days and the road be completed by May 1, 1896.

MONTREAL, QUE.—Money is being subscribed for an electric railway from St. Remi to Napierville. The government has voted a subsidy of $3,200 per mile, and will do the same if the road be extended to Stottsville. James Fowler, United States Consul at Carleton Place, and Thomas Henry, Canadian agent of the Northern Pacific Railway Company, are interested.

NIAGARA FALLS, ONT.—W. M. Kyle, of Toronto, has secured the right of way for a belt line electric railway on the Canadian side of the Niagara River, extending from the lower suspension bridge to Lundy's Lane battleground, overlooking both falls and the upper and lower river. It will skirt along the high bluff down Clifton House hill, to the upper suspension bridge.

PHILADELPHIA, PA.—It is announced that the People's Traction Company is considering estimates for the equipment of the Callowhill Street line with the trolley without delay, so as to have that branch of the system in operation by electricity during the Fall. The introduction of the trolley there will remove about the last horse-car line from the streets of Philadelphia.

PHILADELPHIA, PA.—The Philadelphia Traction Company has built three cars for carrying mails over its lines. They have been reconstructed from old cable cars. They have their own motors, and will be divided, half being used for postal business and the other half for passengers. Like those on the Fourth and Eighth Streets route, they are painted white, with silver lettering.

HOBOKEN, N. J.—Col. E. A. Stevens, president of the Hoboken Railway, Warehouse & Steam Connecting Railway Company, has made application to the Hoboken Common Council for permission to build an electric railway along the river front, to afford direct connection between the steamship docks and the railways. The proposed line is to run through Hudson and Fourth Streets and Willow Avenue.

NEVADA, MO.—The electric light and power franchise proposition, submitted to a municipal vote, was approved by a majority of about 20 to 1. The franchise was awarded by the Nevada City Council to Colonel George V. Dudley, of St. Louis, on a bid of 2½ per cent. of the gross receipts. It runs for 10 years and calls for 50 lights at $90 each per annum and the maintenance of a street railway system.

PHILADELPHIA, PA.—George H. Rumford has brought suit against the Philadelphia Traction Company to recover damages for being ejected from a car of the defendant company, on Broad Street, on Dec. 24 last. Mr. Rumford alleges that he paid his fare, but that the conductor insisted that he had not, and, upon his refusal to pay again, put him off, subjecting him to great ignominy and disgrace.

LOUISVILLE, KY.—It is now almost certain that the electric railway between Louisville and Fairfield will be built. The $9,000 necessary to secure a charter has been subscribed, and articles will be prepared without delay. Among those interested are Judge W. H. Ellaby and F. H. Carrithers, of Mt. Washington; Judge W. B. Hoke, L. De Witt, Stephen Lloyd, James McKenna, and Robert Mills, of Louisville.

ORCHARD LAKE, MICH.—The Town Board has granted to J. Summer Rogers, Seymour Brownell and William G. Hinman the franchise conveying the right to build through the town of West Bloomfield, a street or tram railway to connect with the lines of Detroit. The boards of all the towns excepting one, through which this proposed line will pass, have already granted franchises to the three gentlemen mentioned.

BALTIMORE, MD.—H. C. Ridgely and other persons residing on the Liberty road and adjacent country are projecting plans for another new suburban electric railway. It is understood that the Baltimore Traction Company is backing the movement. It is the intention of the projectors to build a railway from Powhatan to Harrisonville, connecting with the Gwynn Oak branch of the Baltimore Traction Company's system at Powhatan.

PHILADELPHIA, PA.—Joseph W. Hunsicker, through his attorney, George T. Hunsicker, has filed a bill in equity, in Court No. 4, against the Frankford & Southwark, Philadelphia City Passenger Railway Company and the Electric Traction Company, in which the court is asked to restrain the defendants from laying their tracks on Old Second Street, or the Kensington & Oxford turnpike, in front of the plaintiff's property.

PHILADELPHIA, PA.—The committee of the Board of Highway Supervisors to which was referred the protests against the granting of a permit to the Moyamensing Avenue & Penrose Ferry Passenger Railway, has reported that there are no grounds for the objections, and has recommended the granting of the permit to go on with the work on condition that the company be required to pave and repave all the streets on which its tracks are laid.

TO BUILD COOK ELEVATED RAILWAY SYSTEM.—A construction company in Chicago is to be formed to build a line of the Cook Elevated Railway. The inventor, Lucien F. Cook, states that it has not been decided where the first line would be built, but it would probably be between Chicago and Milwaukee. Mr. Cook's system consists of a single-post elevated structure, on which runs two lines of cars, the cars being suspended to the structure by wheels.

NEW YORK, N. Y.—The Third Avenue Company has been successful again in its application for a franchise for the Kingsbridge route. The petition was granted by the Board of Aldermen by a vote of 22 to 8. It is considered altogether likely that the Mayor will veto the resolution, in spite of the probability that it will be passed over his veto. The franchise is to be sold at auction, but the route adopted is such that the Third Avenue Company has the advantage as the bidder.

WASHINGTON, D. C.—A public meeting was recently held at Lay Hill, Montgomery County, to take action in regard to the construction of an electric railway from Lay Hill to connect with the Kensington and Chevy Chase road, or with an extension of the Brightwood line. Charles H. Parker presided at the meeting, and appointed H. W. Cashell, Headly Beall and O. H. Van Horn a committee to arrange for future meetings. M. L. Littlefield was instructed to ascertain who would give the right of way for the line.

SYRACUSE, N. Y.—It is announced by those interested in the Syracuse & Suburban Railway Company, which has been organized for the purpose of building an electric railway from the corner of Fayette and South Salina Streets, through East Fayette Street to the eastern line of the city, and thence along highways to Fayetteville and Manlius and possibly to Chittenango, that they have succeeded in securing the consents of the owners of a majority of the property along East Fayette Street to the construction and operation of the proposed line.

POTTSVILLE, PA.—The Schuylkill Electric Railway has entered into negotiations with the Philadelphia Construction Company to extend the railway lines six miles westward from their terminus at Minersville through the Heckscherville Valley, a densely settled district, to Taylorville. Also six miles south from Pottsville to Cressona and Schuylkill Haven. Bids are being advertised for, and it is intended to break ground on Sept. 2, and push the construction to a completion before the frosts set in. This company is doing a tremendous traffic this Summer.

GEORGETOWN, MASS.—At a special town meeting recently to take action on the petition of the Haverhill, Georgetown & Danvers electric road, for a location through this place, a resolution was adopted, stating "that we, as citizens of Georgetown, welcome the proposed road into our town, and that we are perfectly willing to leave the matter of location and other incidentals of interest in the hands of the Selectmen." The amount of $100,000 is already subscribed to build the road as far as the town, and it will be done as soon as the county commissioners have approved the route.

SEA ISLE CITY.—A movement is on foot to build a trolley road from Stone Harbor, at the lower end of Seven Mile Beach, to Cape May Court House. The distance is about four and one half miles, and the cost of the road will be upward of $100,000. One long bridge and several smaller ones will have to be built. It is proposed to light Stone Harbor, Peermont and Avalon with electricity from the trolley system. Connections will be made at Cape May Court House with the South Jersey and West Jersey Railways, and in the run from Philadelphia to the Seven Mile Beach resorts fully twenty minutes will be saved.

MASSILLON, O.—The Wadsworth Electric Railway Company has been formed to build a road from Wooster to Cleveland. It is privileged to carry passengers, baggage, express goods, United States mails and freight; to build single or double track, with all necessary spurs, switches, etc. The significance of the spurs is in this: It is designed to be a road for the public, thrown out where cars can be left for farmers, dairymen, gardeners and others to load their products, which can be run to meet any market at any point along the line, thus enabling persons within five miles of the road on either side to avail themselves of any market. In a circular the company says: "We expect to haul farm products, hay and straw in bales, grain, dairy products, coal, dry goods, boots and shoes, clothing, etc. So it will be of value to all classes of society and for all commercial interests. It is proposed to run express cars at 20 miles per hour, accommodation cars that will pick you up and let you off anywhere, and freight cars."

SAN FRANCISCO, CAL.—An enterprise which will involve an outlay of $2,000,000 or $3,000,000, and which, if successful, will supply San Francisco with 20,000 hp to be used in running an electric road and opening a new irrigation project, has been undertaken by California capitalists, whose plans are now so far advanced as to be made public in detail. Seventy-five miles north of San Francisco there is situated, at an elevation of 1,317 feet above the sea, a body of water known as Clear Lake. It has its outlet in Cache Creek, a stream supplying 327,000,000 gallons of water daily. The plan of the newly formed company is to construct a big dam on the creek about five miles below the lake outlet. From this reservoir the water will be carried in large pipes along the stream to a point known as Wilson's farm, where the power plant will be established. In traversing this distance the water will have a fall of 454 feet. It is estimated that three lines of pipe will develop 28,950 hp at the dynamos, 72 per cent. of which, by electrical transmission, would deliver 20,845 hp to stationary and railway motors in San Francisco.

PERSONAL NOTES.

MR. WILLIAM F. FORBY, of the Okonite Company, New York, died on Aug. 15 at Roxbury, Mass. The funeral took place at his home in Albany on Aug. 18.

MR. C. M. WICKER, vice-president and general manager of the Brooklyn, Queens County & Suburban Railway Company, has been seriously ill of late as the result of the return of a trouble resulting from an accident during the strike of last Winter. At that time his buggy was overturned, and he was confined to the house for two weeks. Mr. Wicker's condition has been steadily improving during the last few days.

TRADE NOTES.

CHAS. G. ARMSTRONG, Auditorium Building, Chicago, is making figures on a large plant for Messrs. Godfrey & Hyde for the Mabley & Company's Building, at Detroit. Plans and specifications can be had at Chas. Armstrong's office, in Chicago.

THE ALEXANDER CAR REPLACER MANUFACTURING COMPANY, of Scranton, Pa., has received the most flattering testimonials from persons who have tested its car replacer. A large number of steam railways in all parts of the country are using the device with good results. The type, which is designed for use of electric railway companies, is built on exactly the same lines as the larger replacers, and of the same quality of materials.

IT IS ANNOUNCED that the works of the Pennsylvania Steel Company have not been so crowded with orders as at present for at least three years. Every department is being run to its fullest capacity, and in many of them day and night turns are kept steadily engaged. Orders are coming in daily in large numbers, and present indications point to a period of prosperity such as has not been recently witnessed. Prices are generally satisfactory, and a further advance in several kinds of manufactured goods is confidently expected,

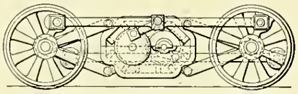
Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED AUGUST 20, 1895.

544,677. TROLLEY ARM AND ATTACHMENT; G. Maag, Newark, N. J. Filed Dec. 12, 1894. The trolley arm is composed of sections with a flexible joint connecting same and a flexible rod within, and means for securing the rod in position.

544,685. ELECTRIC LOCOMOTIVE; Edward H. Porter, Radford, Va. Filed June 22, 1894. This is the combination in an electric locomotive, with the driving axles of the locomotive, of cranks of a given radius carried thereby, main connecting rods joining those cranks which are on different axles; a pair of armatures of an electric motor, having cranks of half the length of the former, and connecting rods joining the armature cranks to the main connecting rods and having the same radius as the cranks of the driving wheels of the locomotive. (See Illustration.)

544,692. CAR FENDER; John F. Saitz and Frederick W. McKee, Pittsburg, Pa., assignors to Frederick W. McKee and Samuel Kelly, same place. Filed May 6, 1895. This is a swinging fender having a cross-bar intermediate of its ends. A continuous rocking lever has a vertical arm extending up within the car and a horizontal arm extending forwardly beneath the cross-bar and on which the cross-bar rests. There is a releasable connection between the cross-bar and horizontal arm.



NO. 544,685.—ELECTRIC LOCOMOTIVE.

544,742. CAR FENDER; Francis McDowell, Philadelphia, Pa. Filed Feb. 7, 1895. The fender is vertically movable in guides, a tripping-bar being pivotally attached to the bottom of the car and connected at its rear end with the fender. A spring is adapted to yieldingly retain the fender in a lowered position and a device is provided for normally retaining the forward end of the tripping-bar depressed. Means are employed for releasing the bar, and brake mechanism is adapted to be actuated by the release of the bar.

544,750. CAR FENDER; John A. Shank, Lancaster, Pa., assignor of one half to Henry R. Wolpert, same place. Filed June 21, 1895. A hinged frame is connected with the car and extends outward therefrom, a supplemental frame or extension being hinged to the frame. A spring-actuated roller is mounted on the car and arranged transversely thereof. An apron or covering is connected with the supplemental frame or extension and with the roller and adapted to be wound thereon, springs being connected with the frames for holding them in operative position.

544,774. AUTOMATIC SAFETY TROLLEY; J. B. Scranton, New Haven, Conn. Filed March 30, 1895. The trolley finder consists of a forked arm having blocks therein capable of a limited vertical movement and springs tending to force the blocks upward. An axle bears in the blocks and divergent fingers are connected thereto, the free ends of the fingers being forced upward or downward as the blocks are raised or lowered.

544,779. CAR FENDER; Joseph N. Wieczorek, Boston, Mass. Filed Jan. 15, 1895. This is a pivoted car fender and a spring pressed pivoted locking lever holds it normally raised above the track and connected to a loosely hung pawl. A pivoted locking lever engages the pawl and a pedal bolt is adapted to impart movement to a rock shaft and release the pawl from its locking lever.

544,794. TROLLEY ARM AND WIRE FINDER; F. W. Riess, Philadelphia, Pa. Filed June 10, 1895. The trolley arm and finder consist of two parts pivoted together, the upper and very short part being provided with a sliding fork containing the wheel and wire finders, and a spring is adapted to keep the guard in about an axial line.

544,854. CAR FENDER; John J. Kirkness, Baltimore, Md. Filed April 20, 1895. The fender comprises an upright back; a horizontal platform, adapted to be tilted up parallel therewith; jointed braces connecting the back and platform; sliding rods extending longitudinally at the top of the car, and a chain or cord connecting between the sliding rods and the horizontal platform to assist in supporting the latter.

544,862. ELECTRIC RAILWAY; J. F. McLaughlin, Philadelphia, Pa. Filed April 17, 1895. Exposed contact blocks are arranged at intervals along the roadbed. Magnetically operated switches couple the main conductor to the contact blocks, and traveling electromagnets operate the switches. A collector is mounted independent of the magnets, bridging the contact blocks the circuit connections of which are controlled by two successive switches, and consisting of a rigid metallic frame carrying a series of independently spring-actuated yielding contact brushes.

544,863. ELECTRIC RAILWAY; James F. McLaughlin, Philadelphia, Pa. Filed May 3, 1895. This is the combination with a main or supply conductor and feeding conductors or contacts, of switches for coupling the main and feeding conductors, each switch being provided with a rocking switch lever, extending transversely to the line of travel and having an armature on each side of its pivot and two traveling electromagnets, one acting on one armature and the other on the other armature of the switch levers.

544,873. CAR FENDER; August Weismantel, Brooklyn, N. Y. Filed May 6, 1895. The fender is hinged to the forward end of the platform, springs connecting it with the dashboard. A rod is secured at one end to the car fender and provided at its opposite end with a hook. A catch is secured to the under side of the car platform, and is adapted to engage with the free end of the rod.

544,874. RAILWAY SWITCH; Charles F. Wilson, Brooklyn, N. Y. Filed March 29, 1895. This covers in combination a railway rail, a switch tongue, a horizontally swinging angle lever for swinging the tongue, a vertically vibrating lever, a forward and backward swinging switch-operating lever mounted upon one arm of the vibrating lever, a connection between the horizontally swinging angle lever and switch-operating lever, a vertically swinging angle lever pivoted to the rail in advance of the switch-operating lever and connected thereto to swing it in one direction to close the switch, and a projection on the car for engaging the switch-operating lever when it is raised for opening the switch.

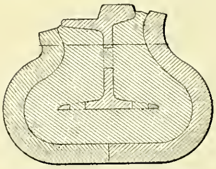
544,888. CAR BRAKE AND STARTER; Henry Eschweiler, San Francisco, Cal., assignor of one fourth to Eugene J. Keller, same place. Filed Dec. 4, 1894. The car brake and starter consists of a spring adapted to coil about the hub of a gear or gears which are fulcrumed to stand essentially at right angles with the car axle. There is a mechanism by which the gears may be tilted to one side or the other, pinions being fixed upon the car axle so that one of the pinions is engaged when the gears are tilted to one side, and the spring will be coiled thereby, and the other pinion is engaged when the gear is tilted in the opposite direction so that the spring in the act of uncoiling will apply its power to rotate the axle and start the car.

544,919. CAR FENDER; John B. Hoagland, St. Louis, Mo., assignor of five eighths to L. Frank Ottoffy and James A. Lane, same place. Filed April 8, 1895. The car fender comprises a pair of journal boxes located upon the end of a car, a shaft journaled in the boxes, a U-shaped frame having its ends fixed to the shaft, a U-shaped frame having its ends pivoted near the ends of and to the first mentioned frame, chains connecting the U-shaped frames, chains connecting the upper end of the last mentioned frame to the dashboard, a flexible net connecting the ends of the frames, a bevel gear pinion located upon the transversely positioned shaft, suitable journal bearings located upon the dashboard and in vertical alignment with each other, a shaft journaled in the bearings, a bevel gear pinion mounted upon the lower end of the shaft and meshing with the first mentioned bevel gear pinion, a ratchet wheel located upon the shaft, a spring-actuated dog for engaging the teeth of the ratchet wheel, and an operating handle for operating the shaft.

544,936. CAR BRAKE; Charles F. Shoemaker, Chicago, Ill. Filed April 20, 1895. This is the combination, with an axle and a brake wheel secured thereon, and provided with a peripheral V-groove, of a brake constructed in two segmental sections, pivotally attached to a support located below the centre of the axle. Each brake section is provided with a brake shoe V-shaped in cross-section to enter and fill the groove in the brake wheel. An angle lever is fulcrumed upon the upper end of one of the brake sections, its vertical member being shorter than its horizontal member. There is a link connection between the vertical member of the lever and the upper end of the opposing brake section, a crank shaft, and a toggle connection between the crank shaft and the horizontal member of the lever.

544,973. FARE RECEIVER AND REGISTER; John Evans, Kensington, South Australia. Filed Oct. 29, 1894. Patented in New South Wales, May 17, 1894. The fare box comprises a case, a hinged receiver adapted to swing into and out of the case, a verifying window in the case, a hinged flap arranged below the receiver and adapted to be moved toward the window, a tube on the lower part of the case, a storage receptacle connected to the tube, a registering apparatus in the case, an operating lever projecting from the case, and operative connections between the lever and the receiver, and also between the lever and the registering apparatus.

545,009. TROLLEY; G. W. Biddell, Chattanooga, Tenn. Filed Feb., 1895. The trolley has a sleeve or head on the end of a rod with a block pivoted upon the top thereof having a shoulder and carrying the wheel; screws extend inwardly through the block to project inwardly beyond the same and abut against the shoulder to adjust the throw of the wheel.



NO. 545,040—RAIL JOINT.

545,039. LIFE-SAVING GUARD AND FENDER FOR TROLLEY CARS etc.; Joseph Weinmann and Benjamin F. Sharp, Philadelphia, Pa. Filed Dec. 24, 1894. A tubular frame is supported at its front end by means of a detachable catch and a cross bar. A frame is connected with a truck of a car, a shoe having a tube telescoping in the tubular frame and provided with a pin supported on the truck frame. A trigger with an arm extends through the shoe tube and is connected with a lever for disengaging the pin from the truck frame. Means are provided for detaching the catch from the cross bar.

545,040. RAIL JOINT AND METHOD OF FORMING SAME; Albert Hoffmann and Herman W. Falk, Milwaukee, Wis. Filed March 18, 1895. This method of forming rail joints consists in cleaning the rail ends to be joined, forming or adjusting a mould upon the rail ends and over the joint so as to surround the webs and base flanges thereof. The mould is heated to the rail ends, and moulten metal is poured into the mould around and beneath the base flanges of both rails and uniting the metal directly to the surfaces of the rail ends by fusion. (See Illustration.)

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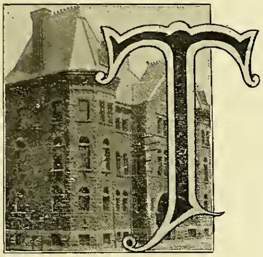
PENNSYLVANIA STREET RAILWAY CONVENTION.



THE annual convention of the Pennsylvania Street Railway Association was held last Wednesday and Thursday in the pleasant city of Wilkesbarre. The hosts of the association were the representatives of the Wilkes Barre & Wyoming Valley Traction Company, and nothing was left undone to make the stay of the visitors thoroughly enjoyable. The headquarters of the Association were at the Wyoming Valley House, which looks out on the Susquehanna River, and the meetings were held at the Ninth Regiment Armory, a few blocks distant, where the exhibit of street railway supplies was located. All visitors were furnished with tickets on the local street railway system, so that the fact that the headquarters and place of meeting were some little distance apart did not prove to be a matter of inconvenience.

The first session of the convention was held in the assembly room in the Ninth Regiment Armory. After President Rigg had called the meeting to order, he introduced Mayor E. D. Nichols, who gave an address of welcome substantially as follows:

B. F. MEYERS, PRESIDENT OF THE ASSOCIATION AND PRESIDENT OF THE WILKES BARRE & WYOMING VALLEY TRACTION COMPANY.

ADDRESS OF WELCOME.

"Of course the gentlemen recognize the fact that they could not meet here in convention without first procuring a permit from the Mayor. Hence they will not disregard any of the conditions he imposes upon the privilege thus vouchsafed to them. In order to justify the restrictions I have decided to designate, it is not necessary to advance any reason other than that furnished in my understanding of the chief object of the organization they are serving. I confess that I may be governed by an error in this behalf. Nevertheless I do not hesitate to proclaim the interpretation, because it is fully approved in the judgment of all the people of this commonwealth not receiving dividends or other benefits, such as free passes, etc., from street railway companies.

"We entertain the notion that this association was instituted to secure the banishment of pedestrians and vehicles from the streets, lanes and alleys of all our cities, and other communities whose opportunities can supply tributaries to the Amazonian stream of profits pouring into the exchequer of its master. In other words, the giant combination represented in this gathering is the headlight of the Trolley Juggernaut, under whose carriage wheels the rights and safety of the people are pulverized and extinguished. In this preamble I am sure I have presented full warrant for the qualifications contained in the lease of this city I have prepared for you. In this instrument you are granted permission to use and occupy the premises, together with all and singular the improvements, ways, watercourses, rights, liberties, privileges, hereditaments and appurtenances whatever thereunto belonging or in any wise appertaining, for all lawful purposes. In this general stipulation there are two things to which I specially direct your attention:

"First. You are requested to observe the omission, from its language, of the terms 'reversions and remainders.' To relieve the meaning of this omission from all ambiguity, and for the purpose of compelling you to yield obedience to our intention, before the delivery of your muniment of title, I declare, in your presence and hearing, that we do not expect you to take anything away with you which you do not absorb during the term of your tenancy. We shall insist upon the strictest observance of this limitation.

"Second. You will notice I have underscored the word lawful. This adjective is used to exclude from the scope of the privilege of the grant liberty to embark in any enterprises or amusements prohibited in either of the statutes or the ordinances of our city. I do not allude to this feature of the indenture because of the slightest suspicion that any of you are afflicted with any moral weaknesses or propelled by any cyclonic inclinations opposed to good citizenship or individual uprightness. But because I desire to impress upon your minds the fact that it is safer to adjust your conduct to the lines of our local regulations than to follow the lead of any of your entertainers here.

"The next and last abbreviation clause I have written in the lease is in the form of a prohibition and directly relates to the mission of your visit here. In your conferences, for the purpose of obtaining an increase of the knowledge you and your constituency exercise in operating railways and securing street privileges, you will engage in the discussion of certain themes and propositions. In this respect we are not unmindful of the constitutional guarantee, but inasmuch as you have elected to accept as the basis of your right to enter and assemble in our city, the consent of the mayor, you are bound to submit to all reservations and exceptions he may prescribe. Availing ourselves of the opportunity thus afforded us we deny you the right to discuss the subject: 'How' to purloin public streets and manipulate the councils of cities and boroughs.'

"Self preservation is the first law of human nature. We cannot endure further loss of the right to use our public thoroughfares without contracting all the bodily ills resulting from the absence of pedestrial exercise and plunging our lively establishments into hopeless bankruptcy.

"Now, gentlemen, subject to the conditions I have named, I welcome you to this city, and I am certain that its hospitality will fill the measure of your most generous expectations. Like all other communities in which the electric street railway system has been established, we many times feel that its operators are too greedy in their encroachment upon the rights of the public. But after all, we are compelled to admit that the enterprise is one of the greatest blessings of the age. Surely the truth of this statement is not more clearly demonstrated in any section of the country than in this city. We are proud of the magnificent service the street railways furnish here and to their presence we are largely indebted for the growing prosperity we are now enjoying."

The address was responded to by ex-Mayor James R. Kenney, of Reading, a delegate from the Reading Traction Company. He thanked the Mayor for his cordial greeting, and said he could appreciate Wilkes Barre hospitality for he had often enjoyed it.

The convention then adjourned until 2 p. m.

ADDRESS BY A. K. BAYLOR.

At the afternoon session Mr. A. K. Baylor, of the General Electric Company, was called upon to discuss the topic, "Power Consumption by Electric Railways." He prefaced his address by the remark that while the consideration of the subject might very properly begin with the coal pile he would follow it back no further than the engine shaft. The first question to confront the purchaser of a generator to which the power was to be supplied was whether the machine was to be belted or directly coupled to the engine shaft. The last two or three years the tendency had been in favor of direct-coupled machines. Where economy of space was an item of importance, because of the high value of land, and when the units were large the choice now would fall upon the machines of this type. In the old days it was supposed that the great fluctuations in the load, inevitable in railway work, would throw too great a strain upon the engine, but with a flywheel of proper size between the engine and generator it was demonstrated that this was a negligible factor. Even in the case of roads on which few cars were operated and where the variations were of consequence great the best direct-coupled machines worked without trouble and without excessive sparking.

The first question to be considered on comparing the two types of machines was the cost. This was to the disadvantage of the direct-coupled generator. As it was prepared to run at slower speed with this machine, it was necessary to increase the armature conductors and the fields, especially when the speed was reduced to 75 revolutions per minute, as in the larger units. We now had, said the speaker, armatures six and seven feet in diameter. While the cost was greater for these machines, we could deduct the cost of the belt. The fact that these machines occupied less room has already been referred to. The cost of foundations is somewhat less, that is, the cost of the larger foundations for engine and generator will be less than that for two foundations needed in the case of the belted generators. Nowadays most engine rooms are equipped with traveling cranes, and as the span was less in the case of a room containing direct-coupled units than one containing belted generators, a saving would be effected for this reason.

Mr. Baylor then discussed the matter of the proper number of units for the equipment of a station, considering it from several points of view. He seemed to incline to the belief that an arrangement with three units, any two of which were able to carry the load, while the third was kept in reserve, was preferable to that in which two machines carried the load while one of half the size served as the reserve. In this latter case the station would be unable to supply the maximum requirement should one of the larger machines be crippled, without danger resulting from excessive load on the remaining machines.

At the same time he pointed out the desirability of keeping a full load on each machine so far as possible, as the efficiency curve dropped rapidly when the load fell below a given point.

The efficiency curve of a diagram should be, he said, carefully considered by the purchaser. See that it is a "flat" curve—that is, the curve should rise to 90 degrees or thereabouts, at comparatively small load, and gradually rise to maximum, maintaining practically a horizontal line until the load becomes excessive. This was to be considered in studying different makes of generators. All modern builders are striving to construct efficient machines, but which is most efficient is a question for the purchaser to determine. The machine should be so constructed that its conductor will not heat, proper radiating surface must be provided, it must have proper bearings, the brushes must be ample for a reasonable overload, especially in railway work, the spark factor must be safe; in fact it should be remembered that every heat unit in the machine is a dead loss and signifies a useless inroad on the coal pile. All these conditions have been studied with the utmost care by the engineers of electrical constructing companies, and it is fair to assume that their knowledge is more complete than that of the engineer of a railway company, who has given the matter, perhaps, only casual attention. The buying company should not dictate regarding the details in the construction of their generators, for example, the insulation, speed, etc. They may make a grave mistake if they follow this course, and by causing builders to follow their directions may force the latter to give them less efficient machines than would otherwise be supplied. Mr. Baylor mentioned a case in point, in which the generators constructed according to a company's specifications were less efficient than the standard machines of another well-known constructing company.

The speaker next referred to the line, and emphasized the fact that good insulation was essential as any leakage was a dead loss. The ground return should be ample for an abundance of copper in the air, with poor rail bonds, was an absurdity. The question of providing a good return circuit was a serious one, and merited careful consideration. The feeders should be so distributed that the motors could receive current at the potential for which they were designed, but not in excess of this. He mentioned cases in which the feeders were so laid out that the motors received 550 volts, and even in excess of this figure in passing the power station. When the motors remained perfectly clean no harm resulted, and the speed of the cars was merely accelerated, but dirt collected, and danger to the motors might result from the formation of an arc. Such practice should not exist; but the feeders should run both ways from the station, and be cut in at such points that with the drop the potential would not be greater than that for which the motors were designed.

JOHN GRAHAM, GENERAL MANAGER OF THE WILKES BARRE & WYOMING VALLEY TRACTION COMPANY.

Another factor of prime importance, as relating to efficiency, was the motor itself, and what had been said in reference to generators and their construction applied in a general way to the motor. It should be light, have proper bearings, run coal, and be properly proportioned.

Mr. Bâylor then took up the matter of control, pointing out somewhat at length the economy of the series-parallel controller as compared with the rheostatic controller. Advantages other than economy also dictated the wisdom of equipping cars for the series-parallel method of control. In the case of a breakdown and half the power only was available, all the cars could be run in series at half speed, and traffic could be handled, which was a matter of vast importance, especially during Winter under conditions when the demand of the public was to be carried in the cars and thus escape the necessity of walking in the storm, but when quickness was not of such vital importance.

The speaker then referred to the desirability of securing a record, day by day, of the amount of power necessary for the operation of cars on a road. He pointed out the advantage of obtaining figures of this kind by a recording wattmeter. It could soon be determined just how much output was necessary for given conditions, for pleasant and rainy days in summer, and for pleasant and stormy days in winter. By obtaining records of this kind load curves could be established which would form standards, and these should be lived up to. If there were a departure it would be an indication that something was the matter. A leak might exist, the ground return might be broken, or something else might be at fault. Without the information given by the record the loss might not be apparent. With this record at hand the cause of the loss would be investigated at once. It was worthy of note, Mr. Baylor said, how frequently, under similar conditions, the load curves would be duplicated—a fact which would indicate that they may form proper standards by which to check the consumption of power. Mr. Baylor also suggested that wattmeter readings on cars be taken from time to time under different conditions. From these could be established standard units for power consumption; whether, for example, 800 or 900 watt-hours per car mile should be consumed. If this was the figure to-day and it was different to-morrow something was the matter, and an investigation should be instituted.

Mr. Baylor suggested that a check should be put on the dynamo men. They were human and sometimes fell short in their duty. He recommended that a recording voltmeter be placed in the station, so that a record might be available. Theoretically the record should be a circle and in practice it should approach that. If the voltage ran down to 450, then up to 500 and again to 550, making, of course, due allowance for over-compounding, the dynamo man was not doing his work properly. With the recording voltmeter his work could be rightly scrutinized. It should be borne in mind in this connection that the motors used more current and more horse-power when the potential was low. There is only one way to keep a check on the voltage in this respect and that is by the use of the recording voltmeter.

One of the greatest factors in the economy of power, said the speaker, was the intelligence of the motormen. They are too often left to their own devices and handle their cars unskillfully and uneconomically. For example, they move the controller handle from No. 1 to No. 2 without waiting for the acceleration of the first notch, so on to No. 3 and No. 4, with the result that they might almost as well throw it at once over from the first to the last notch. Mr. Baylor suggested that they should be trained on a car having an ammeter in plain sight. This would show them exactly what they were doing, and would teach the men what the instructor would find it exceedingly difficult to explain. The motorman should be furnished with diagrams showing the connections of motors and controller and should un-

W. G. ENO, SECRETARY OF THE WILKES BARRE & WYOMING VALLEY TRACTION COMPANY.

derstand just what took place as he moved his controller handle. If he was a conscientious man he would soon unconsciously try to economize current. Many intelligent motormen saved current by coasting instead of running their cars almost up to the point where they are to stop and then applying the brake. In the same way they used the momentum of cars to round curves or switches, or at any points where there was resistance to the wheels. Mr. Baylor next spoke of the desirability of so arranging schedules that a considerable number of cars should not be climbing a grade at the same time. This was a matter which was not easy to accomplish, but at the same time it was worthy of careful study as a possible means of reducing the total output of a station.

The need of careful inspection of bearings, running gear, trucks, etc., was emphasized. It was important to see that the gauge of track and the gauge of wheels was not varying. It was necessary to see that the diameters of wheels were the same in order that the slipping effect, with the consequent loss of power, might be avoided. Mr. Baylor mentioned the fact that in examining wheels supposed to be identical he had in a number of instances found a difference of a full inch in the diameters.

In conclusion, Mr. Baylor spoke of starting cars after a circuit breaker had opened the circuit. On some roads it was the practice to divide the motormen into classes. The first class, for example, started their cars as soon as the power came on the line; the second class started 15 seconds later; the third class in 30 seconds and the fourth-class in 45 seconds. On other roads it was the rule to run the motors in series for a certain length of time. Still, again, it was the practice to hold up the circuit breaker. The speaker did not express his opinion as to the best method, saying the question was a practical one, which was, perhaps, best decided by those engaged in the actual operation of roads.

QUESTION OF LEGISLATION.

When the topic of legislation was reached, W. H. Lanius, of York, spoke somewhat at length. He did not think the Association had been sufficiently active in doing the work for which it had been primarily organized, that is, in influencing legislation favorable to street railway companies. He thought a great work lay before the organization. If those present imagined that the great steam railway companies intended to allow electric railway companies to obtain beneficial legislation if they could prevent it, they were, in his opinion, greatly mistaken. He referred to recent decisions of the Supreme Court as unfavorable to the electric railway interest, and said if any one could tell him how at the present time any company could safely build a line from one town to another he would be greatly obliged for the information. He thought something should be done to give electric railways the right of eminent domain so that their multiplication which so greatly advanced the prosperity of the country districts should not be interfered with.

Mr. Davis, of Williamsport, asked if it was thought that land could be more cheaply secured by exercising the right of eminent domain, than by purchase.

Mr. Lanius said the desirability of securing the right of eminent domain lay altogether outside the matter of cost. As the law now stood, the owner of a single piece of land might successfully block the construction of a projected road. The owner might be interested in a steam road and oppose the new line for this reason only. He thought some way of overcoming opposition of this kind should be found.

William H. Hayes, of West Chester, said that the Association had made some effort to secure favorable legislation, but nothing had yet been accomplished. He thought, however, that the trouble which had been complained of would cure itself. The Pennsylvania Railway, at the present time, was, he said, operating one electric road and was contemplating the construction of another. The company would probably want the same legislation that the electric railway companies needed. Again, public sentiment would have its effect and might so influence legislation that the electric railway companies might secure the relief which they required. In reply to Mr. Davis, he said that he certainly believed it wise to proceed without the exercise of the right of eminent domain, if rights could be secured without it, because high damages, much too high, were awarded to owners of property. At the same time it was impossible to build roads in some cases, unless the companies possessed the right of eminent domain, and legislation was therefore needed. He did not entirely agree with Mr. Lanius regarding the decisions of the Supreme Court. This body was showing a tendency to protect railway companies against juries. He cited a recent decision in an accident case as an illustration in proof.

TREASURER'S REPORT.

The report of the treasurer, W. H. Lanius, was presented. Membership fees paid during the year aggregated $1,636.29, and the Association now had to its credit $1,587.70.

ELECTION OF OFFICERS.

The following officers were elected for the ensuing year:

President, B. F. Meyers, of Harrisburg, of the Wilkes Barre & Wyoming Valley Traction Company.

First Vice-President, John Lloyd, City Passenger Railway Company Altoona.

Second Vice-President, Robert E. Wright, Allentown & Bethlehem Traction Company, Allentown.

Secretary, S. P. Light, Lebanon & Annville Railway Company, Lebanon.

Treasurer, W. H. Lanius, York Street Railway Company, York.

Executive Committee, B. F. Meyers, Harrisburg; S. P. Light, Lebanon; John A. Rigg, Reading; Alvin Markle, Hazleton; John F. Ostrom, Steelton.

It was voted that the next meeting of the Association should be held in Altoona. It was announced that a special train for the Montreal Convention of the American Street Railway Association would leave the Grand Central Station in New York at 6 p. m. on Oct. 14, arriving in Montreal at 8 a. m. on the following day. All were invited to accompany the train.

The convention adjourned *sine die*.

EVENING CONCERT.

In the evening the visitors enjoyed a concert at Hanover Park, which had been arranged especially in their honor. Music was furnished by the Ninth Regiment Band.

EXCURSION.

The morning of Thursday was devoted to an inspection of the exhibits of street railway supplies, and in the afternoon the visitors enjoyed an excursion over the lines of the WilkesBarre & Wyoming Valley Traction Company, and a lunch at Hanover Park closed the meeting. The ride was an exceedingly enjoyable one as the lines pass through a beautiful country surrounded by mountains on every side. To the street railway man there is much of interest in the system, as the apparatus and equipment are of an exceedingly varied character. The main power station is located on South Main Street. Here four Edison two-pole 200-kw machines have been installed. They are connected by Page and Schultz belts to four Ideal compound engines of 300 hp each, made by the Harrisburg Foundry & Machine Works. Steam is furnished by boilers of an aggregate capacity of 600 hp, made by the same company. To meet the demand for increased power the company at the present time is building an extension to its station, which will double its capacity. Two 400-kw General Electric machines will be installed directly, coupled to engines built by the Harrisburg Foundry and Machine Company. The boilers will be furnished by the Vulcan Iron Works of Wilkes Barre.

On the west side the company has a second power station containing an Ide engine and a Corliss engine belted to short generators.

The company operates 50 cars in regular service, and this number is increased as the occasion demands. They were built by the J. G. Brill and St. Louis car companies. They are all vestibuled, even those designed exclusively for summer service. The cars are all mounted on Brill trucks, including a considerable number of the maximum traction type. The motor equipment is varied and includes Westinghouse No. 36 and No. 3, General Electric W. P. 30, W. P. 50, and G. E. 800, Short 20-hp and 30-hp, two Baxter 25-hp and several old Sprague double reduction motors.

The system includes about 60 miles of track, and extends to 31 different towns. In Wilkes Barre streets the track is laid with Johnson girder rails, but elsewhere T rails are in use. The overhead material for the most part was furnished by the H. W. Johns Manufacturing Company, but on certain lines material made by the Western Electric Company and the Ohio Brass Company is in use. The officers of the company are: President, B. F. Meyers; secretary, W. G. Eno; treasurer and general manager, John Graham; electrical engineer and master mechanic, James Fagan; superintendent, J. C. Meixell; assistant superintendent, John Clifford.

Exhibits and Convention Notes.

The exhibit of street railway supplies was made at the Ninth Regiment Armory, on South Main Street. The main hall is an ideal room for exhibition purposes, and it was unfortunate that manufacturers did not take a greater interest in this feature of the convention. The showing was much less than had been expected, and was a disappointment to those who had the matter in hand. Following is a list of the exhibitors:

The H. W. Johns Manufacturing Company made the most extensive exhibit in the hall, and its booth, which was tastefully arranged, contained a great variety of samples of the different lines of supplies made by the company. The company displayed an elaborate line of vulcabeston for motor and controller parts, and a complete assortment of moulded mica trolley wire hangers, including cross sections of the principal insulators, straight under-run insulators, crossovers, both right-angled and adjustable, and straight under-run section insulators. The company departed from its usual custom and exhibited a full line of its asbestos goods, including pipe covering, locomotive lagging, asbestos liquid paints and asbestos packings of all kinds. The exhibit was one of no little interest and attracted a great deal of attention. The representatives of the company were D. T. Dickson, general manager of the Philadelphia branch of the company; J. W. Perry, of the Philadelphia branch, and Charles T. Grier, the company's representative in the district.

The Consolidated Car Heating Company, of Albany, N. Y., exhibited its electric heaters for street railway cars. Heaters made by the company have been used in Wilkesbarre, and have given good results. The exhibit showed the several types of standard electric heaters, including those used in cars having panels, and those with cross seats. Those used in the latter type of cars are of two kinds, one where the aisle is at the side, and the other where the aisle is in the center. A heater designed to be attached to the outside of the panel was also shown. The three styles of switches used by the company were on exhibition, one providing for five intensities of current and one for three intensities, and the third a snap switch. The company was represented by H. N. Rausom.

The St. Louis Register Company made an exhibit of its fare registers. One type was examined with special interest. This register provides for recording transfers as well as fares. The pointer indicating the number of transfers is red, while that denoting fares is black. The register has two bells which have different tones and two totalizers. This register, as well as the standard Security registers made by the company, are simple in construction and are made to withstand the hard service to which this important part of a car equipment is always subjected. The company was represented by G. S. Allison, manager of the New York office.

The Forest City Electric Company, of Cleveland, O., showed samples of its roll drop commutator bars, which are cast from pure lake copper and rolled or drop-forged to size by special machinery. The New York representative of the company, John C. Dolph, was present.

The Quaker City Rubber Company, of Philadelphia, made a display of rubber goods of various kinds designed for electrical purposes. These included rubber belts, hose, caskets, tubing, tape and trolley coats. The company also showed samples of the leather belting which it handles. Samples of the company's packing, for which it makes especial claims, were exhibited. E. M. French, of the Wilkes Barre office, represented the company.

The Tide Water Oil Company, of which J. C. Paine is the Wilkes Barre representative, showed samples of various kinds of lubricating oils.

A. Whitney & Son, of Philadelphia, Pa., exhibited a pair of 33-inch wheels designed for electric car service. Some loose wheels were also shown, as well as samples of brake shoes. Visitors connected with mining interests were attracted by a pair of Faught closed hub self-oiling wheels, which are in use in some of the principal mines in the country. The firm has, up to this time, sold over 30,000 wheels of this type. Under ordinary conditions of service they require oiling only once a month. The firm is now selling railway wheels and axles to some of the largest companies in the country, and its foreign trade is rapidly growing. F. A. Lex was the firm's representative.

Thomas H. Holmes, of Wilkes Barre, exhibited his piston rod packing. A piston head was used for showing how the packing was applied.

The Atlantic Refining Company, of Wilkes Barre, made an exhibit of its lubricating oils which, arranged in vials in tasteful form, made an attractive display.

The McGuire Manufacturing Company, of Chicago, was represented by J. A. Hanna, of the New York office. He announced that the company was finding a large demand for its snow sweepers.

A. K. Baylor, who contributed an address on the "Consumption of Power by Electric Railways," felt that he was dealt with rather severely by the Wilkes Barre press. One paper announced that he discussed the topic of the "power of consumption," and another stated that he suggested the use of anemometers on electric cars.

E. F. De Witt, of Lansingburg, N. Y., exhibited a model of his sand box, which during the last two years has proved popular with street railway companies.

Frank Mansfield, of Breese & Mansfield, Philadelphia representatives of the Walker Manufacturing Company, of Cleveland, exhibited a model of the latter's spring-hung railway motor, and called attention to its excellent qualities.

Charles J. Mayer, of Philadelphia, showed samples of the goods of the R. D. Nuttall Company, of Allegheny, Pa., for which he is the Philadelphia representative.

The General Electric Company was represented by A. K. Baylor, R. E. Moore, of New York, and H. J. Crowley, of Philadelphia. The feature of the business meeting was Mr. Baylor's address.

The Westinghouse Electric & Manufacturing Company was represented by Arthur H. Allen, of the Philadelphia office.

The J. G. Brill Company's representative was as usual Wm. H. Heulings, Jr., and its interests did not suffer at his hands.

To John Graham, manager, and W. G. Eno, secretary, of the Wilkes Barre & Wyoming Valley Traction Company, the thanks of every visitor were due. They were indefatigable in their efforts to make the stay of the visitors enjoyable.

DELEGATES AND VISITORS.

Following is a list of those in attendance at the convention.

Ash, A. W., Schuylkill Traction Company, Girardville, Pa.

Allen, Arthur H., Philadelphia Agency Westinghouse Electric & Manufacturing Company.

Allison, G. S., New York representative St. Louis Register Company.

Arrowsmith, A. V., Reading Traction Company, Reading, Pa.

Beard, W. K., New York representative of *The Car*.

Baylor, A. K., General Electric Company, New York, N. Y.

Blake, H. W., *Street Railway Journal*, New York, N. Y.

Bonnell, James A., Carbon County Railway Company, Mauch Chunk, Pa.

Bent, F. H., Harrisburg Traction Company, Harrisburg, Pa.

Biddle, Walter, Wilkes Barre & Wyoming Valley Traction Company, Wilkes Barre, Pa.

Crowley, H. J., General Electric Company, Philadelphia, Pa.

Clifford, John Wilkes Barre & Wyoming Valley Traction Company, Wilkes Barre, Pa.

Cochran, J. W., Williamsport Passenger Railway Company, Williamsport, Pa.

Dickson, David T., Philadelphia branch of the H. W. Johns Manufacturing Company.

Durfee, W. B., Jr., Composite Brake Shoe Company, Boston.

Dolph, John C., New York representative of the Forest City Electric Works, of Cleveland.

Dibble, Theo. H., Scranton representative of the Washburn & Moen Manufacturing Company.

DeWitt, C. F., Lansingburg, N. Y.

Dickerson, J. W., Electric Railway Gazette, New York.

Dick, Henry C., Flood & Conklin Company, Newark, N. J.

Davis, Ernest H., Williamsport Passenger Railway Company, Williamsport, Pa.

Duckett, W. S., Altoona Passenger Railway Company, Altoona, Pa.

Eno, W. G., Wilkes Barre & Wyoming Valley Traction Company, Wilkesbarre, Pa.

Ellicott, John, New York Car Wheel Works, Buffalo, N. Y.

French, E. M., Quaker City Rubber Company, Philadelphia.

Fagan, James, Wilkes Barre & Wyoming Valley Traction Company.

Grier, Charles T., Philadelphia branch H. W. Johns Manufacturing Company, of New York.

Goddard, S. H., *Electrical Review*, New York.

Graham, John, Wilkes Barre & Wyoming Valley Traction Company, Wilkesbarre, Pa.

Hanna, J. A., New York representative of the McGuire Manufacturing Company, of Chicago.

Harrington, W. E., Cutter Electrical & Manufacturing Company, Philadelphia.

Hollenback, John W., Wilkes Barre & Wyoming Valley Traction Company, Wilkes Barre.

Hayes, William M., West Chester Street Railway Company, West Chester.

Heulings, W. H., Jr., J. G. Brill Company, Philadelphia, Pa.

Holmes, Thomas H., Wilkes Barre, Pa.

Kenfield, Fred. S., *Street Railway Review*, Chicago, Ill.

Keyes, Frederick A., Philadelphia Office Washburn & Moen Company.

Kenney, James R., Reading Traction Company, Reading, Pa.

Lex., F. A., A. Whitney & Son, Philadelphia.

Light, S. P., Lebanon & Annville Railway Company, Lebanon, Pa.

Lanius, W. H., York Street Railway Company, of York, Ya.

Musser, F. B., Harrisburg Traction Company, Harrisburg.

Markle, A., Lehigh Traction Company, Hazleton, Pa.

Moore, R. E., General Electric Company, New York.

Mayer, Charles J., Philadelphia, representative of R. D. Nuttall, of Allegheny.

Meyers, B. F. Wilkes Barre & Wyoming Valley Traction Company, Wilkesbarre.

Mansfield, Frank, Breese & Mansfield Company, Philadelphia.

Morse, George C., Rochester Car Wheel Works, Rochester, N. Y.

Meixell, J. C., Wilkes Barre & Wyoming Valley Traction Company, Wilkesbarre.

Magee, F. A., E. S. Greeley & Co., New York, N. Y.

Maccartney, J. F., New York representative of the Ohio Brass Company.

Nicholson, S. L., James Boyd & Bro., Philadelphia, Pa.

Ostrom, J. F., Philadelphia representative Pennsylvania Steel Company.

Pugh, John S., John Stephenson Company, New York.

Perry, J. W., Philadelphia Branch H. W. Johns Manufacturing Company, of New York.

Paine, J. C., Tide Water Oil Company, Wilkes Barre, Pa.

Pullen, F. T., Peckham Motor Truck & Wheel Company, New York, N. Y.

Ransom, H. N., Consolidated Car Heating Company, Albany, N. Y.

Russell, F. D., Rochester Car Wheel Works, Rochester, N. Y.

Ruth, John, Lebanon, Pa.

Rigg, John A., Reading Traction Company, Reading, Pa.

Seely, John A., New York, N. Y.

Swan, C. J., Wilkes Barre & Wyoming Valley Traction Company, Wilkes Barre, Pa.

Thompson, D. W., Lehigh Traction Company, Hazleton, Pa.

Vosburg, A. C., New Process Rawhide Company, Syracuse, N. Y.

Vandergrift, F. B., *The Car*, Philadelphia, Pa.

Wiley, Jay, New York office Western Electric Company.

Wright, Thomas A., Wilkes Barre & Wyoming Valley Traction Company, Wilkes Barre.

Yardley, John H., Philadelphia Car Wheel Company, Philadelphia.

No Three-Cent Fares for Cincinnati.

One of the aldermen of Cincinnati has announced his intention of introducing an ordinance compelling the Cincinnati Street Railway Company to reduce its fares from five to three cents. John Kilgour, president of the company, states that the company will not lower its rate, however, as it cannot afford to do so. "We are now carrying a great many people practically free," he said. "Take the reports of this company for Aug. 18. There were 127,000 rides taken at five cents each. Of these 35,000 persons took transfers. Of the transfers 31,000 were used, so 31,000 people took rides on transfers, which are really given for nothing. Sunday, however, is a big day for street railway business, bigger than any other day of the week. Now, beside this giving of transfers, we yearly give away to institutions 100,000 free rides. In July we averaged 20,000 transfers a day, or $1,000 if people paid as they once did, for each ride. It can easily be seen that we cannot afford to give three-cent rides when we give the transfers. No company can run at loss."

Street Railway Engineers—XIX.

EDWARD P. BURCH.

The fact is often noted that the men engaged in electrical engineering work, the professors, designers, and practical engineers in the factories and power plants, are young and enthusiastic. These young men, with proper advantages and thorough technical training, readily grasp the principles underlying the new sciences and soon become qualified to assume charge of new lines of engineering work. Mr. Edward P. Burch is one of these young men, filling a position of great responsibility in the electrical engineering field. He was born in Menominee, Wis., in 1870. After he had graduated from the high school in that place he entered the Minnesota State University, which was one of the first institutions to equip its laboratories for technical electrical work and to furnish thorough instruction in this department. Mr. Burch began his practical work as wireman with the Chicago Edison Company, and later was engaged by the company in its Adams Street station as a draughtsman and for the installation of machinery. His summer vacations while a student were devoted to practical electrical work. At the age of 20 he was appointed instructor in electrical engineering, a position seldom open to an undergraduate. In June, 1892, he was graduated from the institution. His graduating technical thesis on the "Street Railway Motor," was read before the American Institute of Electrical Engineers at its Chicago meeting, and attracted no little attention. He was soon after identified with the Twin City Rapid Transit Company, which in Minneapolis and St. Paul then controlled the most extensive electric railway system in the world. He was first engaged in testing motors and subsequently devoted much time to redesigning different types of Sprague, Thomson-Houston, S. R. G., F. 30 and the heavy motors used under the 30-ton 45-foot interurban trains. After hundreds of characteristics and distribution of potential curves had been made, the characteristics, efficiency and capacity were radically improved and their tendency to spark diminished. He also assisted in developing the practical, efficient controller, a type somewhat different from that in use in other cities, in service on all the cars belonging to the Twin City Rapid Transit Company. A year of this work was followed by a year as electrician of the Minneapolis division of the company, during which time he introduced a number of changes. About two years ago he was appointed electrical engineer for the entire system. In this position he now has charge of the electrical department which includes the power houses, which have a combined working capacity of 9000 E. hp and the extensive feeder and conduit systems of both cities, furnishing power for 230 miles of trolley lines that provide transportation for 350,000 persons. Mr. Burch is specially interested in heavy railway work, and his lecture on "Economy of Conductors in the Transportation of Power for Railway Work," of which a report appeared in the ELECTRIC RAILWAY GAZETTE of July 27 last, bears evidence of the hard study which he gives to problems in the traction field. His training and practical engineering work have qualified him to discharge in a most complete manner the duties of manager of the electrical department of a large company which expects reliability and economy in operation.

EDWARD P. BURCH.

Boston Rapid Transit Subway.

The Boston Subway Commission has advertised for sealed proposals for building the second section of the subway, which includes the Boylston Street station to be located at the corner of Boylston and Tremont Streets. The first section will be connected with the second and will complete the subway from Church Street to West Street. Some particulars are estimated to be as follows: 54,000 cubic yards of earth excavation, 47,000 cubic yards of surplus earth, to be removed; 1,150 tons of iron and steel, furnished by the commission, to be set in place; 10,900 cubic yards of concrete, stone and brick masonry.

Bids will be received at the commission's office until noon of Sept. 19. Each contractor must deposit $5,000 as a guarantee of good faith.

The Boylston Street arm of section two will be a two-track subway, similar to the one now under construction, while the Tremont Street portion will conform with the four-track section of section one. It is at the Boylston Street station that the subway is to be built to avoid a grade crossing, deflecting the cars that continue south from Boylston Street under the Boylston Street tracks.

Isle of Man Mountain Railway.

The Snaefell electric line, which extends from Laxey in the Isle of Man to the summit of Snaefell, over 2,000 feet above the sea level, has been completed. There is a continuous gradient of 1 in 12 on the entire line, which is 4¾ miles in length. As a measure of safety a centre rail has been laid, on which specially designed emergency brakes act. The road was recently inspected on behalf of the Manx government. The emergency brakes were applied when the car was on the steepest incline, and the car, which was weighted to equal an ordinary load of passengers, was brought to a standstill within its own length. The electrical plant was installed by Mather & Platt. The line is operated in connection with the Douglas and Laxey electric roads.

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As THE ONLY PUBLICATION in the world DEVOTED TO THE ELECTRIC RAILWAY INDUSTRY, and the only journal adequately treating THE NUMEROUS TECHNICAL FEATURES INVOLVED IN ITS MODERN DEVELOPMENT AND PRACTICE, the ELECTRIC RAILWAY GAZETTE aims worthily to represent the activity and progressiveness of the important interests to which it is devoted. Presenting ALL THE NEWS EVERY WEEK, and describing CURRENT IMPROVEMENTS AND DEVELOPMENTS immediately upon being brought forward, its pages offer to those engaged in the electric railway field the TIMELY ADVANTAGES ENJOYED IN OTHER ACTIVE AND IMPORTANT BRANCHES OF MODERN INDUSTRY, and to advertisers A LIVE AND ENERGETIC MEDIUM commensurate with their needs and one giving CLOSEST ACCESS TO THE COMMERCIAL OPPORTUNITIES OF AN EXTENSIVE AND GROWING BUSINESS.

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MONTREAL CONVENTION AND STATE MEETINGS.

It is expected that the convention of the American Street Railway Association in Montreal next month will be largely attended, and all indications point to the fact that the exhibit of apparatus and supplies will be extensive and interesting. The plans are well advanced and the Montreal committee expects that the meeting will be one of the most successful in the history of the organization. There is much to interest the street railway man in Montreal. In the construction and in the operation of the roads many novel features have been introduced which will attract the attention of managers from other cities. Every facility will be afforded visitors to investigate these points of interest, and information of value will be placed at their disposal. The next few weeks will see many meetings of street railway representatives. The New York State Street Railway Association will meet in Albany on Sept. 17, and the convention of the Connecticut Association will be held on the following day. On Sept. 19 the Michigan Association will hold its annual session in Grand Rapids, and on the 25th inst. the meeting of the Ohio State Tramway Association will be held in Sandusky. The series of fall conventions will close with the meeting of the American Street Railway Association in Montreal on the third Wednesday in October, for which, as we have already said, plans are well under way.

PENNSYLVANIA STREET RAILWAY CONVENTION.

The first in the series of fall street railway conventions was held this week at Wilkesbarre. The meeting was certainly an enjoyable one, and the representatives of the local electric railway company were unsparing in their efforts to make the gathering one to be remembered for its social features. The attendance of street railway men was not as large as had been expected, and the exhibit of apparatus and supplies was by no means as extensive as had been anticipated. As a matter of fact, sufficient preparation had not been made by the association for the meeting. Certainly there should be no great difficulty in securing three or four papers on live topics, and in prevailing on several members to open the discussions of the different topics, but to secure good results some earnest preliminary work must be done. It is a mistake, we believe, for State associations to confine the topics for consideration to those of a purely technical character. It seems to us that subjects of special local interest to the members of the States organization could be found, which might be considered with profit by associations of this kind. Were this the case and a good programme were arranged and the meeting properly advertised, there would certainly be no falling off in the attendance. So far as the Pennsylvania Street Railway is concerned there certainly should be no difficulty in preparing subjects for consideration of vital interests to all companies in the State at the present time.

If a lively meeting is expected, and a good attendance may be counted upon, no difficulty will be experienced in inducing supply companies to make exhibits of their goods. They are always ready enough to show their wares if a considerable number of buyers are proposing to hold a meeting. The main feature in the programme at the Wilkes Barre convention was a paper by Mr. A. K. Baylor on "Power Consumption by Electric Railways." He presented many points of practical importance to the members, and his excellent address was listened to with a great deal of interest.

The topic of legislation was touched upon briefly. It seems to be the fact that the electric railway companies of the State, if they are not to be hampered in constructing projected lines, need the power of eminent domain. Whether they will be able to induce the legislature to give them the right is another question, as the steam railway croporations are formidable opponents. One speaker criticised the association for failing to act energetically in this matter, and insinuated that it was failing to do the work for which it was formed, that is, to bring to bear strong influence in favor of necessary legislation. This topic formed practically the only one which was discussed. As we have said, the meeting at Wilkes Barre was an enjoyable one, but we wish that a literary programme of greater length and more varied interest had been arranged.

TRAINED MOTORMEN.

The article by Mr. George T. Hanchett in this issue, one of the series on "Practical Hints for Motormen," is deserving of special attention. It deals with the troubles which are likely to be encountered in the operation of an electric car, and of the best and simplest means of locating faults, and, when possible, of overcoming them at once. It would not be easy to refer to any article heretofore published, which presents this information in so practical and simple a manner. The motorman in charge of an electric car should understand the apparatus under his control, sufficiently well to be able to act upon the hints which Mr. Hanchett embodies in his article. It is probably the fact that in many cases they are not competent to do the work, but when trouble occurs must simply await the arrival of the inspector or expert. Such men we believe have not been sufficiently trained, or at least have not been instructed in the proper way. When a motorman takes charge of a car he should know more than the mere fact that the movement of the controller handle will accelerate the speed. He should know what is taking place in the machinery, and should have something of a knowledge of the connections. We believe it to be the fact that motormen who have information of this kind take more interest in their work, operate their cars more intelligently, and in every way serve their employers better. We are glad to realize that as a general rule companies are taking this view of the matter.

Conduit System of the Metropolitan Traction Company.

The operation of the underground conduit system on the Lenox Avenue line in New York City, which was opened to the public on July 9, has been so successful and satisfactory that the directors of the Metropolitan Traction Company have decided to equip its Twenty-third Street line in the same way. The system, which was fully described in the Gazette of July 29, is extremely simple and differs greatly from other systems, both in respect to the conduit and in the method of taking the current from conductors to the motors. The conduit construction is practically the same as that employed on the Broadway cable line, and was so built that in case the electric system proved unsatisfactory the cable could be installed with little expense. A contact plow is suspended from the car truck, passes through a slot in the centre of the track, pressing against the flat surface of two channel-iron conductors which extend the entire length of the conduit. These conductors are placed three inches from the centre of the slot rail, so that they are not affected by water entering the slot.

The conductor bars are secured to the conduit by specially designed insulators, and are at a depth of 13 inches below the top of the seat rail. The conductors being of four inch channel bars are so rigid that suspension is required only at the centre and ends, at which points manholes and handholes are located for easily and quickly making any necessary repairs.

The present power plant of the Lenox Avenue line is located in a temporary building on 146th Street, near Lenox avenue, and consists of two Allis cross-compound Corliss engines of 650 hp each. Each engine is directly connected to a 400-kw G. E. generator of the standard construction, but wound for 350 volts. As the system has proved a success, the plant will probably be increased to 5,000 hp, and the present building replaced by a handsome brick structure, measuring 200 feet by 550 feet. The current for operating the Twenty-third Street line will be supplied from the power plant on Twenty-fifth Street, now in the course of construction.

The building is a handsome structure of granite and brick, seven stories in height and measures about 190 feet by 200 feet. The plant is designed for a total capacity of 12,000 hp.

It has been announced that the system on Lexox Avenue has effected a saving in operating expenses of four cents per car mile as compared with the cost of the cable, and it is authoritatively stated that the company expects within five years to have all of its lines operated by the underground trolley system. The change, it is estimated, would effect a saving of about $2,000,000 per year.

It has also been decided to equip the Ninth Avenue line with the system. This line extends from Fulton Street and Canal Street and Broadway, under the Ninth Avenue Elevated Railway to Sixty-fourth Street, thence along the Boulevard to Seventy-second Street and from there along Amsterdam Avenue to 125th Street.

Receipts Donated to Charity.

The gross receipts on the lines of the Schuylkill Valley Traction Company, of Morristown, Pa., were donated to the Charity Hospital on Aug. 25. The cars were well patronized, many persons seizing the opportunity for combining pleasure with charity. The receipts were $343.75.

Electric Car Tests.

BY HERMANN S. HERING, M.E.,
Assisted by
CHARLES REUTLINGER and B. HARRISON BRANCH.

II.—DETERMINATION OF THE TRACTION COEFFICIENT AND MECHANICAL HORSE-POWER OF THE CARS.

(*Continued from page 136.*)

THE value of the traction coefficient of the cars used in these tests was determined by pulling the test car by means of another motor car to which it was connected by a dynamometer. The test car was equipped with a Boyer speed recorder, which gave an autographic record of the speed, and a Giddings recording dynamometer, which gave an autographic record of the drawbar pull between the cars, and the weight of the cars was determined prior to tests on the car scales of the Baltimore Traction Company.

The cars were run over certain portions of the road where the grades were uniform for a considerable length, as the speeds in that case would be steady, and only that portion of the dynamometer record was used during which the conditions were steady. The value of the grades and the location of the poles were accurately known, and the time of passing the poles was carefully determined.

Fig. 11 shows a typical record from one of the tests which was made on a heavy grade. The record beginning at *a*, shows the dynamometer at zero. Throwing on the first notch of the controller causes the rise at *b* due to the acceleration; then at *c* the second point of the controller causes another rise, and also at *d* the third point, when the motors are in series. This portion of the road is slightly down hill, and from *d* to *e* the grade begins, and the speed likewise diminishes. At *e* the conditions are steady and the readings began at that point. At *f* the readings stopped, as the grade began to change, and the motors were thrown in parallel, which accounted for the acceleration shown in the record. From there to *g* the grade gradually diminished and the speed increased, and from *g* to *h* the car was brought to rest. The value of the dynamometer reading was obtained by integrating the section from *e* to *f*. As this record is on a time base a true mean value, with a fair accuracy was obtained.

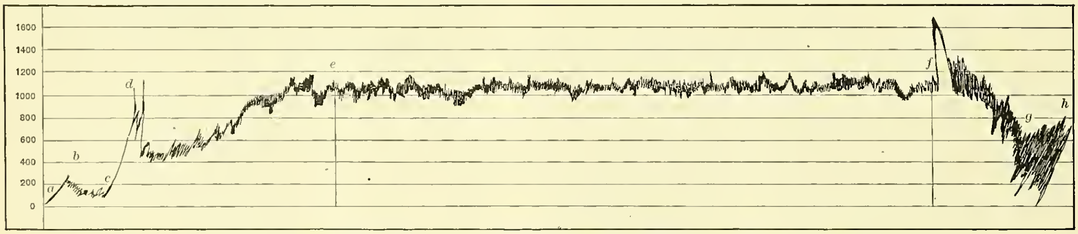

FIG. 11.—TYPICAL RECORD OF DYNAMOMETER—UNIFORM GRADE AND SPEED.

Fig. 12 shows the record made by the dynamometer when pulling the car over varying grades, and thus necessarily at varying speeds and accelerations. The irregularity of the record and the great variations make it very difficult to read, and at high speeds it is much worse than at slow speeds. For that reason the data obtained from uniform grades and steady speeds was alone used, and the record for the round trip merely examined as a matter of interest, as it was useless for empirical data.

Calculation of the Traction Coefficient.

For the benefit of those who are interested in the details of the method of determining the traction coefficient, the following description is given:

When a car is pulled along on a level track the force exerted on the draw-bar is called the force of traction, and is the force required to overcome the friction of the wheels on the rails and of the car axles in the journals, and also in the case of motor cars, of the friction of the gear wheels, brushes and armature. This force of traction, which is the force required to pull the car on a level, is supposed to vary in an exact ratio with the weight of the car, because the friction of the journals and the rails varies with the pressure. In the case of motor cars, however, the friction of the gears and armature is independent of the weight of the car. It is customary, however, to express the value of the coefficient in pounds (horizontal) per 1,000 pounds of weight (or per ton of weight) and for the purpose of these tests this will answer, as the weights of the motor cars did not differ very greatly and the error will thus be small. Not having any level track to work on, the cars were pulled on known grades and the value of the horizontal pull calculated.

On a grade the following conditions exist:

In Fig. 13 let *a*, *b*, *c* represent a grade. The value of the grade in per cent., which is the rise per 100 feet of level, is obviously

$$\text{grade, in per cent.} = \frac{b\,c}{a\,c}$$

If M be the body whose friction is to be determined, W, its weight and R the pressure normal to the surface, then P is the force required to pull the body up the hill, the draw-bar pull, as measured by the dynamometer, which is equal to the force of friction F added to the force L, the component required to simply raise the body. Obviously

$$F = \mu\,R \text{ since } \mu = \frac{F}{R}$$

$$L = W \sin \alpha$$

$$R = W \cos \alpha$$

$$\therefore F = \mu\,W \cos \alpha$$

Therefore the total pull, as measured by the dynamometer, equals

$$P = L + F = W \sin \alpha + \mu\,W \cos \alpha$$

and the coefficient

$$\mu = \frac{P}{W \cos \alpha} - \tan \alpha$$

But since the value of the angle a is small in grades on electric roads, the value of $\cos a$ will practically equal 1 within 1 per cent., which is sufficiently accurate for such tests, as the quantities involved cannot be determined with any greater accuracy.

Therefore, within 1 per cent.

$$\mu = \frac{P}{W} - \tan\alpha$$

and since $\tan\alpha$ = per cent. grade.

$$\text{traction coef.} = \frac{\text{dynamometer pull}}{\text{weight of car}} - \text{per cent. grade.}$$

which is the expression used in obtaining the values given in the tables.

Calculation of the Mechanical Horse-power.

The power required to pull a car up a grade at uniform velocity is obviously the draw-bar pull multiplied by the speed; or if

H. P. = horse-power,

P. = draw-bar pull as measured by the dynamometer,

S. = speed of car in ft. per second,*

then,

$$\text{H. P.} = \frac{PS}{550}$$

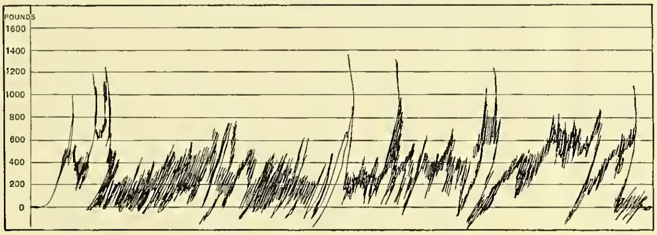

FIG. 12.—TYPICAL RECORD OF GALVANOMETER—VARYING GRADE AND SPEED.

If the traction coefficient of the motor car is the same as the trailer it is pulling, then the horse-power of the two cars is the ratio of their weights and the

$$\text{Total H. P.} = \left(1 + \frac{W_m}{W_t}\right)\frac{PS}{550},$$

W_m and W_t being the weights of the motor and trailer car respectively.

A method of roughly determining the net efficiency of a motor car is to have it pull a car of similar construction and weight, with a dynamometer. The electrical horse-power delivered to the motors can be readily measured with an ammeter and voltmeter, and the mechanical horse-power exerted by the motors, from the speed and dynamometer pull. If the cars are alike, the

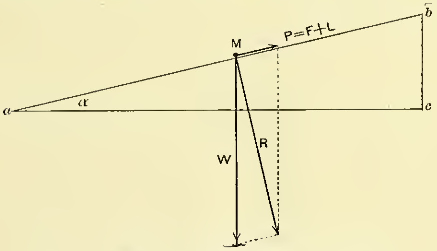

FIG. 13.—ANALYSIS OF FORCES ON GRADES.

$$\text{Total Mech. H. P.} = 2\frac{PS_s}{550} \text{ or } 2\frac{PS_m}{33000} \text{ or } 2\frac{PS_h}{376}$$

according to whether the speed was measured in feet per seconds, per minute, or miles per hour.

A better method would be to have the cars pull each other consecutively up the same grade, and the ratio of the dynamometer readings in the two cases determined. The car to be tested can then pull the other car over the road and if K = the ratio, the mechanical horse-power of the motors can be determined at any point of the road, without knowing the weight of the cars or their traction coefficient.

$$\text{Mech. H. P.} = (1+K)\frac{S_s}{550} \text{ or } (1+K)\frac{S_m}{33000} \text{ or } (1+K)\frac{S_h}{376}$$

according to whether the speed was measured in feet per second, per minute, or miles per hour.

Care must be taken that the dynamometer measures imply the pull parallel to the track and does not include any other component, such as the weight of the drawbars, twist of the couplings, etc., which it will do unless these stresses are prevented.

The *components* of the mechanical horse-power of a car are the power required for

(1) Lifting,
(2) Horizontal traction,
(3) Acceleration.

The forces exerted in these three cases are:

(1) $F_l = W \sin\alpha$ and within 1 per cent. = Wt. × per cent. grade.

(2) $F_t = \mu W \cos\alpha$ and within 1 per cent. = traction coef. × Wt.

(3) $F_a = \pm \frac{W}{g}\frac{(S_1 - S_2)}{t}$

When W = weight, μ = coef., α = angle between grade and horizontal, g, gravity, t, time during which acceleration takes place, and S_1 S_2 the speed in feet per second at the beginning and end of the acceleration. When accelerating, the value of F_a is + and when retarding it is —.

The power exerted is:—

$$\text{(1) Lift H.P.} = \frac{W S \sin\alpha}{550}$$

$$\text{(2) Traction H.P.} = \frac{\mu W S \cos\alpha}{550}$$

$$\text{(3) Accel. H. P.} = \frac{W}{550g}\left(\frac{S_1 - S_2}{t}\right)S$$

when S = the mean speed.

Since, in Fig. 13, $\sin\alpha = \frac{bc}{ab}$ it practically equals $\frac{bc}{ac}$ within one per cent.,

and $\sin\alpha = \tan\alpha$ = per cent. grade,
and $\cos\alpha = 1$ within 1 per cent.

Therefore within 1 per cent.

$$\text{Lift H. P.} = \frac{\text{Wt} \times \text{per cent. grade} \times S}{550}$$

$$\text{Traction H. P.} = \frac{\text{Tract. Coef.} \times \text{Wt.} \times S}{550}$$

The work done in going from a to b, Fig. 13, is practically equal to the work done from a to c, *traction*, and from c to b, *lift*.

The power producing acceleration is obviously equal to the force of acceleration times the mean speed, and the force of acceleration is the mass times the acceleration which latter is the difference in velocity at the beginning and end of the observation divided by the time during which this acceleration takes place.

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* The reason for making the calculation in feet per second in these tests was because the time between poles was measured in seconds, and the distances between poles in feet.

In making the test, the time of passing the poles is carefully determined, from which the time interval can be obtained, and also the mean speed from the time interval and the distance between the poles. If a speed recorder is used and the poles marked on the record at the time of passing, the speed at the poles can be determined, and the acceleration, from the difference between two consecutive poles, but otherwise it will have to be approximated by taking the difference between the consecutive mean speeds between poles.

These components are useful in showing how the mechanical horse-power of the motor is divided, and they have been computed and plotted for some tests made over two roads which will be shown later.

TABLE 2.—OBSERVED AND COMPUTED RESULTS OF THE DETERMINATION OF THE TRACTION COEFFICIENTS OF THE CARS USED IN THE TESTS.

		Track Data.			Time.	Speed.		Traction.			Wgt.	Mech. Horse-power.				
Test Number.	No. of Car Tested.	Pole Numbers between which test was made.	Grade, per cent.	Distance, in ft.	Interval, in seconds.	Feet per second.	Miles per hour.	Dynamometer Pull (corrected).	Equivalent traction pull on horizontal.	Pull per 1,000 lbs. Traction Coefficient.	Trailer car and passengers.	Lift H.P.	Traction H.P.	Total H.P.	Date of Test.	Remarks.
1	2	3	4	5	6_o	7_c	8_c	9_o	10_c	11_c	12_o	13_c	14_c	15_c	16	17
I. 1	Trailer No. 162.	(Old Nos.) 25 to 31,	5.95	744	123.4	6.03	4.11	400	26.4	4.30	6,270	4.09	.29	4.38	1893. June 12.	Track Dry.
2	"	"	5.95	744	125.0	5.95	4.06	400	27.7	4.30	"	4.03	.30	4.33	"	"
Mean.	....	....	....	....	....	....	....	....	....	*4.30*	....	....	....	....	....	....
II. 1	Motor Car No. 233.	26 to 31	5.97	621.6	53.6	11.59	7.90	1,117	110.5	6.55	16,872	21.22	2.33	23.55	June 19.	Track Dry.
2	"	"	5.97	621.6	54.8	11.34	7.73	1,121	114.9	6.81	"	20.77	2.37	23.14	"	"
3	"	46 to 49	2.25	378.7	21.0	18.03	12.29	483	103.6	6.13	"	12.45	3.40	15.85	"	"
4	"	70 to 77	2.53	901.6	56.7	15.90	10.84	528	101.0	5.99	"	12.34	2.92	15.26	"	"
5	"	"	2.53	901.6	57.8	15.60	10.64	539	112.1	6.63	"	12.11	3.18	15.29	"	"
6	"	"	2.53	901.6	53.8	16.75	11.42	530	102.7	6.10	"	13.01	3.13	16.14	"	"
7	"	"	2.53	901.6	56.0	16.10	10.97	538	111.3	6.59	"	12.50	3.26	15.76	"	"
8	"	"	2.53	901.6	52.4	17.20	11.73	531	103.8	6.15	"	13.36	3.25	16.61	"	"
Mean.	"	....	....	....	....	....	....	....	....	*6.37*	....	....	....	....	....	....
III. 1	Motor Car No. 233.	26 to 31	5.97	621.6	52.2	11.90	8.12	1,055	87.3	5.38	16,225	20.95	1.89	22.84	June 16.	Track Wet.
2	"	27 to 31	5.95	487.7	40.8	11.96	8.16	1,058	83.8	5.11	16,375	21.20	1.82	23.02	"	"
3	"	26 to 31	5.97	621.6	170.8	3.64	2.48	1,050	72.5	4.43	"	6.47	0.48	6.95	"	"
Mean.	....	....	....	....	....	....	....	....	....	*4.97*	....	....	....	....	....	....
IV. 1	Motor Car No. 233.	26 to 31	5.97	621.6	58.6	10.60	7.23	1,030	67.5	4.17	16,135	18.57	1.30	19.87	June 17.	Gears Removed. Track Dry.
2	"	"	5.97	621.6	58.6	10.60	7.23	1,043	80.5	4.97	"	18.57	1.55	20.12	"	"
3	"	27 to 31	5.95	487.7	44.2	11.02	7.52	1,032	71.9	4.45	"	19.24	1.44	20.68	"	"
4	"	26 to 29	5.99	381.4	135.4	2.82	1.92	1,029	62.4	3.88	"	4.96	0.32	5.28	"	"
Mean.	....	....	....	....	....	....	....	....	....	*4.37*	....	....	....	....	....	....
V. 1	Motor Car No. 234.	(New Nos.) 24 to 31	5.96	870.5	157.5	5.53	3.77	1,048	87.5	5.41	16,130	9.66	0.88	10.54	1894. May 31.	Track Dry.
2	"	68 to 76	2.60	980.5	142.0	6.90	4.71	512	92.6	5.73	"	5.26	1.16	6.42	"	"
3	"	"	2.60	980.5	68.5	14.30	9.75	516	98.5	6.13	16,055	10.85	2.56	13.41	"	"
4	"	24 to 31	5.96	870.5	307.5	2.83	1.93	1,038	91.3	5.75	15.880	4.87	0.47	5.34	Aug. 10.	"
5	"	69 to 76	2.60	859	164.2	5.23	3.57	509	95.7	6.02	"	3.93	0.91	4.84	"	"
6	"	102 to 109	1.12	851	111.5	7.63	5.20	266	88.0	5.54	"	2.47	1.22	3.69	"	"
7	"	280 to 290	0.70	1,234	156.5	7.89	5.38	202	90.7	5.69	"	1.59	1.30	2.89	"	"
8	"	159 to 170	0.60	1,378	152.7	9.03	6.16	189	93.9	5.91	"	1.56	1.54	3.10	"	"
9	"	198 to 208	0.30	1,198	127.2	9.42	6.43	142	94.7	5.96	"	0.81	1.62	2.43	"	"
10	"	263 to 272	0.20	1,097	111.5	9.84	6.71	121	89.5	5.63	"	0.57	1.60	2.17	"	"
Mean.	....	....	....	....	....	....	....	....	....	*5.78*	....	....	....	....	....	....
VI. 1	Motor Car No. 64.	68 to 76	2.60	980.5	184.0	5.33	3.63	474	80.2	5.29	15,150	3.81	0.78	4.59	1895. May 31.	Track Dry.
2	"	"	2.60	"	201.0	4.88	3.33	478	8.41	5.55	"	3.49	0.75	4.24	"	"
3	"	"	2.60	"	77.0	12.73	8.68	487	91.1	5.97	"	9.16	2.11	11.27	"	"
Mean.	....	....	....	....	....	....	....	....	....	*5.60*	....	....	....	....	....	....

NOTES.—*Car Equipments*—Nos. 233 and 234—2.25 hp, No. 3 S. R. Westinghouse Motors. Single truck, "Bemis." No. 64—2.25 hp "G. E. 800" Motors. Single Truck "Lord Baltimore, No. 2."

Car Weights (actual).—No. 233, 15,694; No. 234, 15,735; No. 64, 14,715; No. 162, 6,110.

Computed Results Obtained as Follows:—Col. 7 = Col. 5 ÷ Col. 6; Col. 8 = Col. 7 × 3,600 ÷ 5,280; Col. 10 = $\frac{\text{Col. 14} \times 550}{\text{Col. 7}}$; Col. 11 = Col. 10 ÷ $\frac{\text{Col. 12}}{1,000}$ = $\frac{\text{Col. 9}}{\text{Col. 12}}$ — Col. 4 × 100; Col. 13 = $\frac{\text{Col. 12} \times \text{Col. 4} \times \text{Col. 7}}{550}$; Col. 14 = Col. 15 — Col. 13 = $\frac{\text{Col. 10} \times \text{Col. 7}}{550}$; Col. 15 = $\frac{\text{Col. 9} \times \text{Col. 7}}{550}$.

Explanatory.—o, at the head of a column means observed values. c, means computed values.

Roman numerals designate the series of tests.

The track data in columns 4 and 5 were taken from recent surveys.

The weights of passengers and crew, as well as cars, are actual.

Table No. 2 contains the results of some of the tests. The first portion of the table contains the values obtained from the Baltimore Traction Company's car No. 233, which was used in the tests made June, 1893, and also of trailer No. 162. The second portion of the table shows the values of car No. 234 (identical in construction and equipment with No. 233) and Lake Roland car No. 64, which were used in the tests made in 1894.

The table shows the location of the car on the road, the grade on which the test was made, the distance the car was operated, the time interval in seconds, and the dynamometer pull. From these and the car weight, the speed, the traction coefficient and the mechanical horse-power were computed, as given in the table.

The average value of the trailer was 4.67 pounds per thousand on a dry track, and for the motor car No. 233 for dry track was 6.37 pounds per thousand.

A test was also made on the track when it was wet, and the average value was found to be 4.97 pounds per thousand. When the gears were removed and a test made of the car without the motors the average value was found to be nearly that of the trailer—namely, 4.67 pounds per thousand. The reason the value of the motor car is greater than that of the trailer is because of the friction of the gears and the armature when the car is being pulled with the gears on.

The value for car No. 234 was found to be 5.78 pounds per thousand, which is slightly less than for No. 233; but this may be due to a different adjustment of the car journals. The value of car No. 64 was found to be 5.60 pounds per thousand, which is slightly less than the other motor cars, but can be accounted for by a difference in the truck friction.

These values can be considered as fairly accurate for the purposes for which they were used, and where the value of the traction coefficient is important, namely, in computing the mechanical horse-power at the car axles of these motor cars. It was found that by pulling the car over the road with a dynamometer this value of the coefficient seemed to be fairly uniform, but the most important tests of the mechanical horse-power were made on the very grades on which the traction coefficient was determined, in order to eliminate any variations as much as possible.

The mechanical horse-power of the round trip as determined in one of the tests, is plotted in subsequent diagrams, and even with a considerable variation of the value of the traction coefficient, the results are more accurate than they can be read, and for those tests, therefore, even approximate values answer so long as no numerical value of the efficiency is required.

(*To be continued.*)

Electrical Equipment of the Manhattan Elevated.

George Gould, president of the Manhattan Elevated Railway of New York, was recently asked regarding the probability of equipping the system electrically. He said: "No definite decision has yet been made by the Manhattan upon the question of substituting electricity. It is impossible to do so yet, because the practicability of using the electric motor for the Manhattan Railway has not yet been demonstrated. I believe that electricity is the coming power for this purpose. As soon as it shall be demonstrated that it is a success our people will take the subject into definite consideration. Practically speaking, and as a matter of fact, the Manhattan Railway is in a different position from almost all, if not all, other roads. We carry 600,000 people a day. We can run no risks; we cannot substitute one power for another as a mere experiment, or a possible or even probable success. We must know absolutely that we can make the substitution successfully before we would be justified in undertaking it. It has been clearly demonstrated that electricity is a power that can be used under certain conditions, but it has not been demonstrated that it is a power capable of handling 600,000 people a day without a hitch. If you will recall the trouble and delay which have resulted from slight causes in Manhattan Railway travel, you will see what might happen with a system in which there was any unknown or uncertain factor. In this great city, whose great arteries of travel are north and south, and where congestion may so readily happen from stoppage of trains, we can make no experiments with the public in substituting one power for another."

Blockading Cars.

One of the Philadelphia papers has of late been protesting against the blockading of electric cars by coal wagons which, backed up against the curb, prevent the passage of the former. It mentions the fact that a single coal wagon will not infrequently cause delay to from 50 to 200 passengers, preventing them from catching trains, meeting appointments and generally disarranging their business. This nuisance is not confined to Philadelphia.

Practical Notes for Motormen.—XIII.

BY GEORGE T. HANCHETT.

5th. *Continual blowing of the fuse.* Of course this is a sign that it receives more than the normal current. If the motor is on a sharp curve or heavy grade when this occurs it is probably all right, but it has too much work to do, and hence calls for an excessive current. If this trouble occurs on the level ground with a straight track the chances are that the motor is calling for too much current, due to its being out of order, or that the current is finding a path to the ground other than through the motor. This last is very easy to test, and should always be tested for before any other move is made. See that all lamps and heater circuits are "off," and pull down the trolley. Allow it to spring up above the trolley wire and make contacts with the side of the wheel, looking carefully for any sparks or arcs that may occur. If there is a spark something is wrong and should be looked up without greater delay than is necessary in taking the car into the barn. If no spark occurs and the car is on a curve or heavy grade, a doubled fuse may be used to get the car over this point, but when plain sailing is reached the size of the fuse should be reduced again. If the fuse causes bother by continually blowing when the car is on a dead level and successfully meets the test of touching the trolley to the wire, it is probable that one or more of the field spools are short circuited. This would cut down the back E. M. F. of the motor and call for excessive current. Or possibly the current finds a path to the ground after it has left the controller. In case of any accident or difficulty which you cannot understand, be sure carefully to note everything, and be able to tell your story to the expert when the car reaches the barn. Hours of time may thus be saved, as your remarks will probably guide him to the fault at once.

6th. *Breaking down of the insulation of the motors.* It used to be a common practice thoroughly to insulate the iron of the motor from the track, but it was both difficult and expensive. A single ground in any piece of dynamo-electric machinery will do no harm, but when two grounds occur trouble of greater or less magnitude always results, according as the two grounds are near together or far apart on the internal circuits of the machine. As at present made all railway motors are grounded hard and fast on one terminal, that terminal being often attached to the motor box itself by means of the "*ground screw.*" Therefore, if the insulation breaks down anywhere on the motor, and allows the wire to touch the ironwork, serious trouble is sure to occur. This breaking down may be caused by lightning or by improper handling of the large dynamos at the power house, or it may be simply the development of a latent weakness. It will be difficult to foresee this trouble.

Almost all that can be done is to locate and cure it after it has occurred. The trouble usually makes itself known by smoke or perhaps by a flame issuing from under the car, and very often the fuse blows. Shut off the power and lift the trap doors. Then give the controller a notch or two in order to locate the flame or smoke. If it issues from the motor itself cut it out, if it be a double-motor car, and proceed with the other motor. If, on the other hand, the trouble be in the external wiring, it should be an easy matter to detect it and tape the injured portion with friction tape.

7th. *The seventh difficulty of starting with a rush instead of gradually* is in itself indicative of its cause. A portion of its regulating resistance is short circuited. This is more likely to be in the controller on the contact fingers than anywhere else, and unless the short circuit is a positive metallic one it will probably reveal itself by smoking when the current is turned on. Of course it may be under the car, but it is always well to look in the simple easy place first.

8th. *The refusal of the car to start till the middle notch is reached* is also self-indicative. One of the motors is cut out either at the proper place for so doing or else it is open circuited. A brush may have jarred out or a connection become loose. Again, it may be in the controller itself or possibly a burned-out wire either in the motor or under the car. Look in all these places for an open circuit and remedy it if possible.

9th. *The car does not increase in speed after the middle notch, but the speed at first is faster than usual.* This occurs only in certain types of controller and then only where the motorman, to save himself trouble, has put in a heavy fuse. It indicates that one of the motors is short circuited, or, rather, partially so. Therefore, when the motors are in series the good motor receives very nearly the entire 500 volts and starts up with an increased rate of speed. When the motors are thrown in parallel the good motor gets no more voltage, while the poor motor with its short-circuited armature calls for a heavy current, but simply delivers it to the ground, doing very little work with it. This difficulty does not often occur.

In investigating difficulties which occur on railway cars always be sure that the trolley is pulled down from the wire. This may save you a very unpleasant if not a serious shock. Do not be content with simply opening the platform switch or the fact that the controller is off. There is one other difficulty which occurs on a street-car motor which is purely of a mechanical nature. In this event it is very convenient to remember the motions of the motors relatively to their car axles. The trouble referred to is the dropping of the motor into the street, due to the giving way of its supports. If both axles were held rigid and the motors started, the forward motor would tend to press heavily down upon its support while the rear motor will tend to ride up off its support. If the accident happens to the forward motor, block the car wheels and reverse the car. Open the platform doors and with a heavy rope or a piece of clothes line doubled four or five times make fast to the supporting stud of the motor.

Lay a crowbar or heavy stick of wood across the doorway and while some one gives the controller a notch or two, pull on the rope. It will surprise you how readily the motor may be lifted and made fast to the supporting bar. Take the blocks from under the wheels and proceed to the nearest car barn, being sure that the motor is cut out. If the accident happens to a rear motor the procedure is much the same, the only difference being that the motor is not reversed when it is desired to lift it, and it is well to allow it to operate while on the way to the barn.

(*To be continued.*)

Bootblacks on Elevated Trains.

The Alley Elevated Company, of Chicago, has leased to a company the privilege of putting bootblacks to work on its trains.

Traction Companies of Philadelphia.

The report of the Electric Traction Company for the year ending with June last has just been published. It shows that the company's business has increased as remarkably as that of the other traction companies since the completion of the overhead trolley system. The monthly traffic has risen from 4,133,726 passengers in July, 1894, to 6,377,694 in June, 1895. The whole number of passengers carried during the year was 58,125,481, an increase of 17,085,133, or 41.6 per cent. over 1894. The gross receipts of the year were $2,151,853.03, and the operating expenses $1,241,583.29, giving net earnings of $910,269.74. The rentals and fixed charges were $924,669.73.

The following figures relating to the three great systems of Philadelphia, which do over 90 per cent. of the street railway business of the city, have recently been compiled and are of special interest at the present time, as the companies are to be consolidated as soon as the preliminaries can be completed:

The Electric Traction Company operates 130 miles of railway, the Philadelphia Traction Company 203 miles, and the People's Traction 79.43 miles. The traffic is fairly well distributed over these lines in proportion to their extent. The passengers carried by the Philadelphia Traction averaged 549 000 per mile of track, and by the People's 565,000 per mile. The average for the Electric is 447,000 per mile, but the reported mileage of this company includes extensions that were not in operation throughout the year, and the proportion for the last month is almost exactly the same as that of the Philadelphia Traction.

The three companies carried last year an aggregate of 214,529,223 passengers, an increase of 42,623,691, or nearly 25 per cent., over the preceding year. Their gross receipts aggregated $9,474,580.05, and their operating expenses $5,612,239.43; their gross earnings $3,862,340.62, and their fixed charges $2,443,253.86, making the net earnings $1,419,086.76. A further deduction of $160,826.92 for taxes, etc., leaves these figures at $1,258,259.84, which represents the clear earnings of the combined system for the year over and above leases and rentals, and independent of construction and equipment.

There is considerable variation in the proportion of operating expenses on the several systems. On the Philadelphia Traction lines it is 64.8 per cent. of the passenger receipts; on the People's 48.4, and on the Electric 58.7 per cent.; but this variation is accounted for by the different periods during which the trolley system has been in operation, the Philadelphia Traction report particularly covering a considerable proportion of cable and horse car service.

Fender Question in Cincinnati.

The Board of Legislation of Cincinnati will probably pass an ordinance compelling all the street railway companies to equip their cars with fenders. The board gave a hearing to the managers a few days ago. They opposed the passage of the ordinance and argued that fenders, by inspiring people with confidence, made them careless. John Kilgour of the Consolidated Company, referred to the fact that few accidents occurred at the corner of Fifth and Walnut Streets and at the corner of Fifth and Vine Streets, although cars were continually passing. People recognized the danger and were careful. Most accidents, he said, happened away from the centre of the city and where traffic was light.

Electric Conduit System Not to Be Introduced.

In an interview recently attributed to P. A. B. Widener, of the Philadelphia Traction Company, the statement was made that the electric railway syndicate in which he was interested would introduce the conduit system on all the lines controlled by it within two years. Mr. Widener states that there is not a particle of truth in the assertion. He is perfectly satisfied with the overhead trolley system.

Another Conduit Road for New York City.

A plan to equip the Eighth Avenue horse-car line in New York City with an electric conduit system is under discussion. George W. Plunkett is quoted as saying that he believes the improvement will be made and that he deems it necessary to provide better facilities on the road, in order to meet the competition of the cable lines.

Comments and Views of Contemporaries.

Light Railways.—The electric railways, so extensively built along the highways in this country in the past few years, will probably eventually serve the same purpose as the light railways of Europe, in respect to freight and express traffic, just as they do now in passenger transportation. It seems likely that in the more rural districts they will become important feeders to the steam lines, while in the neighborhood of the cities they will benefit the market gardener, the milk producer and the agriculturist in general, together with the manufacturer, by bringing his goods direct to market without break in transit.—*Boston Herald.*

Railway Speed.—Till electric railroading is perfected we shall probably see no great increase in the maximum speed of trains. But as there is no limit to the amount of power that can be poured into a dynamo, and as the train unit for long distances under a system of electric propulsion must be a comparatively light one, sustained speed of 80 to 90 miles an hour is quite within the reach of probability. The problem is mainly one of safety in the revolution of the car wheels. A wheel of three feet in diameter going at the rate of 70 miles an hour must revolve nearly 12 times in a second, and the problem of adjusting journals and bearings to the maintenance of such a speed is not an easy one. But doubtless it will be overcome, like other difficulties of more formidable magnitude, and the next century may, before it is old, regard a continuous speed of a mile and a half a minute with the same mild curiosity that we give to the attainment over long distances of 60 miles an hour.—*Boston Herald.*

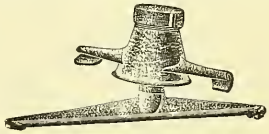
Fender Requirements.—Fenders that do not project in front of the platforms are greatly preferred; but such fenders must not be in the way of the drawbars, brake rods, power boxes, or other machinery beneath the platforms, and they must afford protection from those parts. If fenders project in front of the platforms, the projection must not be more than two or three feet; yet the fender must always cover and guard the hypothenuse of a triangle the perpendicular of which is often as much as two feet, and sometimes more. Projecting fenders must be so constructed that they can be telescoped, folded together, rolled up or in some way made to occupy little room on or under the rear of the car; but they must be simple in construction, and their rigidity, when in use, must not be seriously impaired by the provisions for shutting them up when not in use.

All fenders must be cheap, and this accounts for the fact that so many inventors have sought favor with the trolley men by offering them traps made of wire, gas pipe, band iron and similar materials. That they have found favor is shown by the processions of contrivances that are clattering about the streets in all stages of ridiculous dismemberment. So much for some of the requirements and constrictions under which an inventor must work to earn the half million dollars unofficially offered by an official of a Philadelphia trolley company. Will the Quaker City magnate ever be called upon to make good his offer? Perhaps—when somebody makes a seven-octave calliope out of a titmouse's tail, or stitches a rose leaf to a grindstone on a sewing machine made of toothpicks, or discovers new satellites of Uranus through a lens of gingerbread.—*New York Sun.*

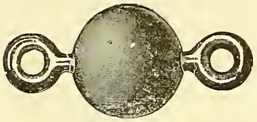
Medbery Hangers and Insulators.

The accompanying illustrations show two styles of straight line hangers and two types of strain insulators made by the Fiberite Company, of Mechanicville, N. Y. It is stated that the Medbery material used in these forms has given the best results in service. All the castings are made of a high grade of aluminum bronze, the studs in all cases are of five-eighths inch drop-forged steel, making the complete device almost indestructible. The other material for electric railways made by this company, including cars, crossings, section insulators, etc., are of the same high grade. During the last four years the company has equipped with its material a large number of leading roads and many smaller lines, and the devices have given entire satisfaction.

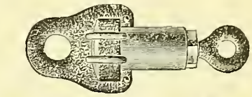
STANDARD STRAIGHT LINE HANGER.



WEST END STRAIGHT LINE HANGER.



GLOBE STRAIN INSULATOR.



BROOKLYN STRAIN INSULATOR.

Glasgow Municipal Tramways.

The first annual report of the committee in charge of the Glasgow, Scotland, municipal tramways has just been published, covering the 11 months from July 1, 1894, to May 31, 1895. About 32 miles of road have been in operation. The mileage run has been nearly 5,200,000, and the number of passengers carried more than 57,100,000. The total revenue has been $1,132,000, and the expenditures $1,011,000, showing a balance to the good of $121,000. Of this latter sum, $45,970 has been "written off the capital account as depreciation"; $32,750 has been "placed to the reserve fund for renewal of permanent way"; and $41,300 has been "paid to the Common Good"—that is, to the municipal treasury as royalty for the use of the streets. The royalty hitherto paid by the private corporation operating the lines, based on the earnings, never exceeded, it is stated, $28,300, and averaged less than half that sum.

FINANCIAL NOTES.

BEATRICE RAILWAY SOLD.—The plant and property of the Beatrice (Neb.) Rapid Transit and Power Company have been sold by order of the United States courts to Victor G. Langtry, of Omaha, for $22,050.

NASSAU COMPANY, OF BROOKLYN.—The gross receipts of the Nassau Electric Company, of Brooklyn, for its first month of operation were in round numbers $47,900. The company has found difficulty by reason of its lack of cars, but the receipt of shipments from the St. Louis Car Company and the J. G. Brill Company has overcome this trouble.

PEORIA CONSOLIDATION.—The Central Railway Company, of Peoria, Ill., has absorbed the Fort Clark Street Railway Company. The formal announcement of the consolidation was made this week. John Finley, general manager of the Central, has been appointed manager of the Fort Clark. A large amount will be immediately expended in the way of improvements.

THE CONSOLIDATED COMPANY, OF PHILADELPHIA.—The revised charter of the application for the Union Traction Company, into which the People's, Electric and Philadelphia Traction companies are to be practically merged, has been forwarded to the secretary of state. The original application, made several weeks ago, placed the capital at $30,000,000, but under the act of Assembly the capital must be placed under that sum, and for the sake of convenience the amount has been changed to $100,000, but the plan is to call a meeting of the stockholders later and increase it to $30,000,000.

CICERO & PROVISO BONDS.—A mortgage for $2,500,000 has been filed by the Cicero & Proviso Street Railway Company, of Chicago, Ill. It was given to the Illinois Trust & Savings Bank, of Chicago, and is for the purpose of securing bonds. The individual bonds have a face value of $1,000, and run for 20 years, with interest at 5 per cent. per annum. About one third of the issue, or bonds to the amount of $871,000, will be used to take up the first mortgage bonds of the road, amounting at par to $740,000. The remaining $1,400,000 of bonds will be expended in improvements and extensions contemplated.

CONEY ISLAND & BROOKLYN RAILWAY REPORT.—The following figures are taken from the report of the Coney Island & Brooklyn Railway Company for the quarter ending June 30: Gross earnings 1895, $353,200; 1894, $306,977; operating expenses 1895, $228,208; 1894, $215,797; net earnings 1895, $124,992; 1894, $91,180; other income 1895, $3,262; 1894, $3,282; gross income 1895, $128,254; 1894, $94,446; fixed charges 1895, $50,676; 1894, $52,608; surplus for year 1895, $37,287; 1894, deficit, $18,142; total surplus June 30, 1895, $77,483; June 30, 1894, $40,145; assets—cost of road, $1,285,758; cost of equipment, $391,444, and other items aggregating $1,716,422. The total betterments during the year amounted to $121,437. The salaries paid aggregated $10,717. There was paid out for injuries to persons the sum of $2,225. The number of passengers carried during the twelve months was 6,394,587. The average number of the company's employees is 250. The length of the road is 12.26 miles. The equipment includes 41 motors and 73 other cars. Twelve persons were injured and four killed during the year.

BICYCLE RAILWAY COMPANY.—The first meeting of the Kings, Queens & Suffolk Railway Company which proposes to build a bicycle railway on Long Island was held last week. F. W. Dunton was chosen president; W. T. Goundie, of the Kings County Elevated Railway of Brooklyn, first vice-president; August Immig, second vice-president; G. P. Bergen, treasurer, and Desmond Dunne, secretary. After the business of the meeting had been concluded, President Dunton said that it was only a question of a short time before the work of building the railway would be started. The trouble, he said, was that people who had subscribed for stock had not paid in their subscriptions. At a meeting held in Jamaica two weeks ago, a hundred stockholders had endorsed the methods being used to raise money, and complete confidence in the management of the railway scheme had been manifested. He said he intended to have meetings in other parts of Long Island to urge the subscribers to the stock to keep to their word.

ALLEY L. REPORT.—At a recent meeting of the stockholders of the South Side Transit Company, of Chicago, or the Alley L, as it is more commonly called, a statement was presented showing the financial condition of the company for the period from Jan. 1 to July 31. The receipts aggregated $495,008, the disbursements $290,949. A calculation was made which showed the net earnings of the company for the year ending Aug. 31, 1895, have been $181,149. This was based on estimated net earnings for August of $9,000, and of net earnings from Sept. 1 to Dec. 31, 1894, of $65,254. The net earnings for the year ending Aug. 31, 1895, were less than half the fixed charges on the first section bonds, to say nothing of the interest on the second section bonds. The impression of the stockholders at the meeting, and an impression which seems to be growing generally, it is that the reorganization when it takes place must be on heroic lines. The stockholders will be forced to bear a heavy assessment, probably $20 a share at least, and perhaps more than that. On the other hand, it will be expected the bondholders will accept radical measures and will submit to a sharp scaling down of their bonds.

BALTIMORE CONSOLIDATION RUMORS.—Banker Hambleton, of Baltimore, says in a circular in reference to the rumors of consolidation in that city: "Again we hear the rumor that a movement looking to a consolidation of the Baltimore Traction and the City & Suburban Railway Company is on foot, and again we beg to express the opinion that the Traction Company should let well enough alone, and should not undertake any new obligations or complications. Since June 1 the earnings of the Traction Company have increased at the rate of $1,000 per day, and this increase still continues and promises to continue." The Philadelphia *Stockholder* makes this comment on the statement: "Consolidations as a rule are beneficial to stockholders, if not to the general public. Several years ago the Traction Company had the opportunity of absorbing what are known as the Bowie lines. It was a mistake that the deal was not made, and the fault rested entirely with the Baltimore Traction management, the head of which, if we remember rightly, was Mr. Hambleton. Had the two systems then been joined there is little doubt that the stockholders of both companies would now be drawing a revenue from their investment in the shape of dividends."

BOSTON WEST END FIGURES.—The Boston News Bureau says: "For the three months ending Sept. 1, the gross earnings of the West End Street Railway Company, of Boston, will foot up over $2,150,000, and show a gain of $275,000. The figures of the gross gain for August are expected to be nearer $120,000 than $100,000, and with half this gain for September the gross gain for the fiscal year will be nearly $700,000. In August the operating expenses were very much less than 60 per cent. of the gross receipts. In the bookkeeping a considerable part of the operating expenses are going into the road bed and power-house extensions, but there is now no question of the ability of the West End to keep itself in repair and pay its stockholders good dividends. For the past year the company has averaged to earn not only 1 per cent. a month upon it common stock, but upon its total capitalization, and for the three months ended to-morrow the average earnings have been 3 per cent. per month on the common stock. Not only will the annual report of the West End Street Railway Company this year show the $7,000,000 mark for gross earnings to have been crossed, but the $7,500,000 mark will be crossed at the same time, and this was the figure set for the gross earnings for the future, when the reconstruction of the company under electrical equipment was begun more than six years ago. Six years ago the gross earnings of the West End Company for the first time crossed the $5,000,000 mark, but under complete electrical equipment and the new subway it should take less than six years to cross the $10,000,000 mark.

NEW INCORPORATIONS.

THE ELECTRIC RAILWAY CONSTRUCTION COMPANY, Kansas City, Mo., has been organized by Eli S. Young, Willard E. Monnor, George Lane, Kansas City, Mo., for the purpose of constructing electric railways, etc. Capital stock, $100,000.

THE CHICAGO CITY STREET RAILWAY COMPANY, Chicago, Ill. capital stock $1,000,000, has been incorporated for the purpose of building, maintaining and operating street railway lines in and about Chicago. The promoters are A. C. Scott, A. J. Hawhe and T. C. Kane.

THE PUEBLO ELECTRIC STREET RAILWAY COMPANY, Pueblo, Col., capital stock $500,000, has been incorporated for the purpose of purchasing and operating the property of the Pueblo City Railway Company. Among the promoters are Albert E. Pattison, Elmer F. Whitted, Anthony C. Campbell, Irving Hale, Frank B. Gibson, Denver, Col.

NEVADA, MO.—The Nevada Electric Railway, Light & Park Company has been organized with a paid-up capital stock of $120,000, and will apply for a charter next week. The company will be composed of George Dudley, Judge Mills, Selden Spencer, F. T. Allison and Dr. T. F. Prewitt, all of St. Louis; C. F. Strohm and Col. Harry Moore, of Nevada.

THE SANTA CLARA VALLEY RAILWAY COMPANY, San Francisco, Cal., has been formed for the purpose of purchasing, building and operating a railway to be operated by steam, electricity or any other motive power; to construct telephone and telegraph lines, and build and operate steamboats. The incorporators are: H. W. Goodall, Frank Piper, Alfred E. Pryor, Charles A. Shurtleff, San Francisco; H. P. Thayer, San Jose; R. J. R. Adan, Vallejo; Andrew Rocca, Great Western Mine. Capital stock, $100,000.

NEWS OF THE WEEK.

AUBURN, N. Y.—The operation of the electric railway has been begun.

VENICE, ILL.—An extension of the Venice, Madison & Granite City electric railway will be made.

SANTIAGO, CAL.—George B. Kerper, owner of the Santiago Cable Railway, will change the motive power to electricity.

LITTLE ROCK, ARK.—The Healey Street Railway Company has been granted a franchise to extend its electric road.

CATAWISSA, PA.—The North Susquehanna Transit Company has applied for street privileges for a new electric railway.

FLAGSTAFF, ARIZ.—Thirty miles of the route for an electric railway from Flagstaff to Grand Canyon has been surveyed.

STOCKTON, N. J.—The Traction Company has been granted a franchise. The company agrees to pay $1 a pole and $5 for each motor.

ST. CLOUD, MINN.—E. E. Clarke, assistant cashier of the First National Bank, has been appointed receiver of the St. Cloud Street Car Company.

JACKSONVILLE, FLA.—It is announced that an electric road connecting Jacksonville with St. Augustine will be in operation by Jan. 1 next. The line will be constructed by the Jacksonville & Tampa Bay Improvement Railway Company.

QUEBEC, CANADA.—It is announced that the construction of the electric railway will be begun in earnest next spring. More preliminary engineering work than was expected has been necessary.

ST. CLAIR, MICH.—There is a project to build an electric road from Detroit to Port Huron. The estimated cost of the entire 65 miles of road, including power stations and all equipment, is $500,000.

HACKENSACK, N. J.—The effort of the Bergen Traction Company to build a trolley line to Hackensack is meeting with opposition, but the corporation declares it will accomplish what it has undertaken.

AKRON, O.—The Akron, Bedford & Cleveland Electric Company has applied to the Kent Council for a franchise for a line through that village. A petition is now before the Commissioners of Portage County for a franchise to Ravena

BRATTLEBORO, VT.—The electric railway is doing a larger business than was anticipated. The first month 60,000 passengers were carried. The company has decided to purchase new cars and snow plows.

PITTSBURG, PA.—President J. D. Callery, of the Second Avenue Traction Company, and President Harry Moore, of the Pittsburg & Birmingham Traction Company, have made an agreement whereby the two lines will be connected.

PITTSBURG, PA.—Another electric street railway is projected ,to afford a short line between the Southside and East Liberty. The plan is to tunnel under Boyd's hill, from a point near the Ft. Pitt incline to the intersection of Forbes and Chestnut Streets.

PHILADELPHIA, PA.—An ordinance has been introduced giving the Grand Boulevard Street Railway Company the right to construct a trolley line in the northern part of the city. Work is to be begun within a year from the passage of the ordinance and finished within two years.

JAMAICA, L. I.—President Hart, of the Long Island Electric Railway, has applied to the highway commissioners for permission to build a bridge over the Long Island Railway tracks at Ozone Park. The company will construct a trolley line from Brooklyn's city line to Inwood as soon as the bridge is built.

COPENHAGEN, N. Y.—The citizens of Copenhagen have secured the right of way for the proposed new railway between that place and Carthage, and also the $10,000 asked as a bonus by the New York Central Railway Company. The proposed road will be about six miles in length, and the estimated cost is $120,000.

DETROIT, MICH.—The Detroit Railway Company has now 23 miles of track constructed, and is operating 38 motor cars. During the next 90 days many new lines, now in the course of construction, will be equipped and started. With these lines the Detroit Railway will have nearly 50 miles of track, reaching much new territory.

BROOKLYN, N. Y.—Notice of appeal has been filed by the plaintiff in the case of John Adamson against the Nassau Electric Railway Company. This is the suit brought to set aside the franchise granted the company. The company's franchises have been declared valid by the General Term and the appeal is taken to the Court of Appeals.

KNOXVILLE, TENN.—The Citizens' Railway Company, of Knoxville, Tenn., has filed an application for a charter. The company proposes to build and operate an electric road in Knoxville, West and North Knoxville and in Knox County. The incorporators are W.G. McAdoo, Jr., F. K. Huger, Geo. W. Henderson, R. H. Sanson, E. T. Sanford and T.H. Heald.

INDEPENDENCE, IA.—Articles of agreement have been filed whereby Richard Campbell leases the electric street railway of Independence, Ia., to the Independence & Rush Park Street Railway Company. This line] is leased to this company by the owner, Mr. Campbell, for $3,000 a year. The company has the option of purchasing the plant at any time for $30,000.

MEADVILLE, PA.—President S. B. Dick, of the Pittsburg, Shenango & Lake Erie Railway Company, is discussing the introduction of electricity as a motive power for passenger and freight trains. The plan is to erect an extensive plant in connection with the Phœnix Iron Works at Meadville, and operate by electricity, at the start, but 15 miles of track between Meadville and Meadville Junction.

HARTFORD, CONN.—The New York, New Haven & Hartford Railway Company has filed in the Superior Court an application for an injunction restraining the Central Electric & Tramway Company, of New Britain, from extending its tracks to Hartford. The steam railway holds that the trolley road will parallel its tracks. The trolley road will contend that it has full authority to build under the provisions of its charter, granted as a horse railway.

BOSTON, MASS.—Alderman Lee has given notice that he would bring up at once the matter of the petitions of the Boston elevated railways for locations. The petition was filed on March 4 last by the promoters of the Meigs elevated scheme, and was for permission to locate the road in different streets in the city. After the hearing the petition remained in the hands of the committee, and it has not yet been able to decide which streets the elevated road shall run through.

CAMDEN, N. J.—The City Council has passed an ordinance granting to the Camden, Gloucester & Woodbury Railway Company the privilege to construct and operate a street railway in and along Third Street, from Kaigh Avenue to Federal Street. The Camden Horse Railway Company, which now carries all passengers from the northern section of the city to the South Camden terminal of the Camden, Gloucester & Woodbury Railway Company, opposed the passage of the ordinance on the ground that it possessed prior legal right to construct a line on the street in question.

CHICAGO, ILL.—It is announced that some action may be taken by the Council to force electric railway companies in Chicago to adopt the conduit system. The success of the Lenox Avenue line in New York has convinced some of the aldermen that the conduit system is practicable and should be used in Chicago. Every ordinance for a trolley franchise granted by the Council contains the provision that in the event of the discovery of any other practicable method of propulsion, such as a conduit system, the company accepting the franchise shall adopt such method by and with the consent of the Council.

MERIDIAN, MISS.—The Boards of Aldermen and Councilmen have adopted a resolution accepting the proposition of F. B. Merrill, of New York, to construct an electric light plant and light the streets of the city and maintain an electric street railway. Mr. Merrill is allowed till the 15th of September to accept the contract, but, on the acceptance thereof, he is required to give bond in the penalty of $1,000 for the faithful performance of the contract. He agrees to begin work within 30 days after the acceptance of the contract, to have the electric light plant in operation by Jan. 1, 1896, and to have five miles or more of the street railway in operation by April 1.

PITTSBURG, PA.—It is reported that the Pennsylvania Railway Company is contemplating the introduction of electricity as a motive power on its main line from Union station to Stewart station. The plans as at present contemplated are said to include the equipment with electricity of the main line for a distance of 16 miles. One of the four tracks will be used and another is to be built. The Pennsylvania is at present paralleled to Wilkinsburg by trolley cars, and the old Braddock system will parallel it from Wilkinsburg to Braddock, and it has also been announced that extensions will be made to Wilmerding. The Pennsylvania officials are anxious to check this competition and the plan proposed to do it is to run trains or single cars every five minutes between the suburban points.

YOUNGSTOWN, O.—Reference has already been made to the electric road which will be constructed by the Park & Falls Company to the southern part of the county. The line will be built principally for carrying coal into Youngstown to supply the local demand. The coal field to be reached has never been tapped by a railway, and contains about 5,000 acres. The equipment will consist of eight motor cars of 100 hp each, and about 100 gondolas for carrying coal. Trains will be operated at eight miles an hour. The steepest grade is only two per cent. The power-house will likely be located near Kyle's Corners. The company has made a careful estimate of the coal consumed in Youngstown, and finds the amount is about 3,000 tons a day. Nearly all the coal banks in this vicinity are practically worked out, so that the Park & Falls Company's principal competitor will be the Pittsburg district.

NEW ORLEANS, LA.—At a recent meeting of the Council an ordinance was introduced directing the sale of the franchise extension of the Canal & Claiborne Railway for a period of 50 years, the purchaser to take in all the authorized extensions for the unexpired term. The sale is to be made in block, by the comptroller, and to go at auction to the highest bidder for cash. The lines to be operated over the same route, or routes, that are now owned by the Canal & Claiborne Railway Company. The bids are in money or by certified check. Should the present owners of the Canal & Claiborne Railway Company become again the purchasers of these franchises, the city is to be relieved of the obligation to acquire the property, subject to right of reversion provided for. All bidders are to deposit with the comptroller the sum of $50,000. The successful bidder shall be required within 20 days of the acceptance of his bid to enter into notarial contract for the performance of his work. The motive power is to be the trolley system or any other improved system of rapid transit, except steam.

TRADE NOTES

THE FIBERITE COMPANY, of Mechanicville, N. Y., reports that its switches for stations and for other purposes are giving great satisfaction. They are simple, durable, economical and effective.

MINING LOCOMOTIVE.—The electric mining locomotive, which is built by the Link Belt Machinery Company, of Chicago, and which was described in the Aug. 24th issue of the Electric Railway Gazette, is in use in the mines of the Essen Coal Company, at Federal, Pa.

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED AUG. 27, 1895.

545,047. STREET CAR FENDER; Richard A. Breul, Bridgeport, Conn. Filed Nov. 5, 1894. There is an approximately U-shaped frame pivoted to the front end of the car with pivoted side braces which are connected by front and middle cross-bars. A netting is attached at its front and rear edges to the front bar of the frame and the middle cross-bar and at its ends to the side bars of the frame, the rear portion of the netting curving up abruptly.

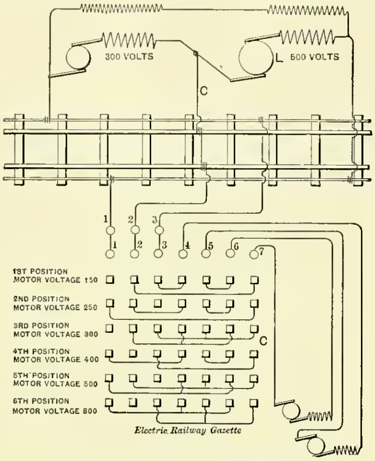
545,070. UNDERGROUND ELECTRIC RAILWAY; David F. Graham, Springfield, Ohio, and William P. Allen, Chicago, Ill., assignor of one third to Oliver S. Kelly, of Springfield, Ohio. Filed June 21, 1894. The conductors in the conduit are arranged on each side of it, and the contacting device consists essentially of bowed contacting springs supported at each end in bearings so as to form a shuttle-shaped device. The contacting springs are supported on the main plate which has bearing shoes at right angles. The shoes are extended laterally beyond the sides of the springs so as to rest on the top of the conductors, when the springs are in contact with the sides of the conductors.

545,073. TROLLEY; Julius N. Hanson, Omaha, Neb. Filed June 4, 1895. The hub is revolubly held upon a suitable post with an extending arm and ears, a trolley pole being movably secured to the latter. There is an adjustable sleeve on the extending arm and also on the trolley pole. An extending bar is movably secured to the arm sleeve, and a bar is movably secured to the pole sleeve. A spring bar is secured to the arm sleeve and continues in a ring and terminates in a stem which is movably secured to the bar that extends from the pole sleeve. A spring bar is movably secured to the pole sleeve and continues in a ring and ends in a stem, the latter being movably secured to the bar extending from the bracket sleeve.

545,112. BRAKE FOR RAILWAY CARS; Joseph W. Valiant, Baltimore, Md. Filed Jan. 11, 1895. The brake staff has a detaining ratchet applied to it adjacent to the dash rail and a pawl is normally in engagement with the ratchet. A crown wheel ratchet is also applied to the brake staff adjacent to the first-named ratchet and a brake staff actuator has a disc at its lower end. One or more pawls are pivoted to the disc and are normally held in engagement with the crown wheel ratchet, so as to impart the rotary motion of the actuator to the brake staff. The pawl-releasing device comprises an annular plate arranged adjacent to the various pawls, and a lever is applied to the actuator and connected with the plate so as to force it against the pawls and detach them from their respective ratchets when the actuator is held quiet. The brake staff is thereby allowed to rotate free of its actuating mechanism, and under the unwinding action of the brake springs, so as to release the brake.

545,142. CAR FENDER; Alfred B. Watson, Paterson, N. J. Filed May 24, 1895. The fender consists of back uprights, front and side bars hinged to the lower ends of the uprights and a cushion surrounding the front bar consisting of a spiral covering of suitable material. A network frame extends from the top ends of the uprights to the front portion or outer ends of the side bars, consisting of sections adapted to fold when the side bars are raised. Netting is secured to each of the folding sections, and braces pivotally connect the central folding point of the network frame and the uprights.

545,151. INSULATED SUPPORT FOR TROLLEY LINES. Frank X. Cicott, New York, N. Y., and Warren J. Belcher and Frederic C. Billings, Hartford, Conn., assignors to the Billings & Spencer Company, Hartford, Conn. Filed April 22, 1895. The insulated support has an insulator stud adapted to support the trolley-line carrier. A protector is adapted to encircle the stud comprising a sleeve and flaring lower portion. A separate yoke is provided with means for connection with a guy-wire, and is adapted to fit on both to the sleeve and lower portion of the protector, being wedged on the latter.


300 VOLTS
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1ST POSITION MOTOR VOLTAGE 150
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3RD POSITION MOTOR VOLTAGE 300
4TH POSITION MOTOR VOLTAGE 400
5TH POSITION MOTOR VOLTAGE 500
6TH POSITION MOTOR VOLTAGE 800
C
Electric Railway Gazette

545,158.—ELECTRIC RAILWAY.

545,158. ELECTRIC RAILWAY; John C. Henry, Westfield, N. J. Filed April 20, 1895. This is the combination with sources of electrical supply arranged to furnish current of varying voltages, of translating devices and a switch adapted to connect them with either or both sides of the source of supply either in series or in parallel. (See Illustration.)

545,186. CAR FENDER; Charles S. Andrews, New York, N. Y. Filed April 23, 1895. Fixed arms are secured to the car platform and to them arms are fulcrumed which support a roller at the outer extreme thereof. There is a downwardly and rearwardly extending guideway with springs thereon for the roller, means being provided for limiting the downward movement of the pivoted arms.

545,187. TROLLEY LINE CLAMP; Warren J. Belcher, Hartford, Conn. Filed April 11, 1895. The upper clamping member comprises a receiving sleeve and a clamping jaw and has an opening intermediate of the lower end of the sleeve and the jaw. The lower clamping member comprises a jaw adapted to extend under the clamping jaw of the upper member and has a longitudinally divided sleeve, the adjoining edges of which meet with the opening of the upper member. The sleeve projects into the receiving sleeve when the members are assembled, means being provided for expanding the divided sleeve and holding the members assembled.

545,204. CONDUIT ELECTRIC RAILWAY; Charles H. Johnson, San Jose, Cal. Filed Feb. 23, 1894. Angle iron is secured to the wall of the conduit and forms a continuous shelf, from which flanges project upward. The insulating material upon the shelf is confined by the flanges, and a wire has its lower portion imbedded in the insulating material.

545,208. UNDERGROUND ELECTRIC RAILWAY; Emma E. Moore, Chicago, Ill. Filed Nov. 16, 1894. The conduit is U-shaped in cross-section and is provided with separate conduits located in the two vertical side walls, each having its upper portion contracted and provided with a slot for the passage of a trolley pole.

545,217. STREET CAR BRAKE; Henry T. Atkinson, Oakland, Cal., assignor of five twelfths to J. E. Morris, same place. Filed Feb. 12, 1895. A cam is fulcrumed upon a standard fixed upon the car and a chain passing around the cam and direction pulley is connected with the brake rod. A lever is fulcrumed upon the same pin with the cam and is adjustably connected with the latter, so that the relative positions of the two may be changed and the movement of the lever and cam caused to act upon the chain and brake with a decreasing motion and increasing power.

545,226. CAR BRAKE; Joseph Friedrichs, St. Louis, Mo., assignor of one half to Henry A. Boeckeler, same place. Filed March 5, 1895. The brake shoes are suspended by links from the rock arms, the links permitting the latter to swing past dead centre while suspending the brake shoes. A lever controls the rock arms, and means are provided for applying the brakes in service stops independently of the rock arms.

545,230. AUTOMATIC SWITCH FOR ELECTRIC OR CABLE RAILWAYS; George T. Janvrin and Frank J. Conlon, Brooklyn, N. Y. Filed Dec. 12, 1894. The switch point has a rigid pendent stud which projects into the space below the rails and a push stud is located at each side of the main track and adapted to be thrust down independently by rolls on the car subject to the control of the motorman. An elbow lever is connected to each push stud and a connecting rod is coupled with each rock lever. A rock lever is coupled with each rod, respectively, and respectively located on opposite sides of the pendent stud and bears upon it, so as to push the switch point either way, as one or the other of the push studs is actuated. Rods connect the rock levers of the push studs with the point-actuating levers, being suitably convergent to connect directly with the push stud levers at the opposite sides of the track and with the point-actuating rock levers located relatively thereto.

545,263. CAR FENDER; William H. Bigler, Philadelphia, Pa. Filed Nov. 27, 1894. The fender has a rising and falling shield and a sliding scoop with inclined rods secured to the car, which furnish supports for the scoop. The shield is adapted to ride in the scoop when the latter is thrust forward or downward.

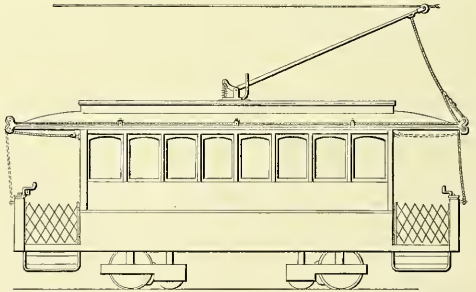
545,290. AUTOMATIC CAR FENDER; John D. Hodges, Ellendale, assignor of two thirds to William Beinker and John Shaw, St. Louis, Mo. Filed July 1, 1895. A frame is fixed beneath the car platform and to it a second frame is hinged at the forward end. A flexible buffer is arranged to move longitudinally upon the forward end of the second mentioned frame. A trigger with a tripping device for it is arranged adjacent to the rear end of the first mentioned frame. The tripping device is operated from the top of the platform, means being provided for automatically releasing the trigger as the buffer engages with an obstruction.

545,291. FARE REGISTER; Stephen C. Houghton, San Francisco, Cal. Filed Sept. 10, 1894. The register is operated by an electric circuit and has two sets of trip registers. The pull-down rod has an electrical contact with and forms part of the main circuit at both ends of the box, connections being made between the rod and the trip registers.

545,306. STREET CAR SIGN; Joseph M. Peter and Winfield Garrett, Cincinnati, O. Filed June 6, 1895. This is the combination of a stationary shaft having a bend or offset therein and a suitable illuminating device mounted in the bend. A pair of standards support the opposite ends of the shaft and an open paneled skeleton frame has a supporting sleeve whereby it is loosely mounted and free to rotate on the shaft. There is an end head in the skeleton frame from which the sleeve projects inwardly and around the shaft, and a pair of latched door plates is located at the opposite open end of the frame. A cylinder or sign proper with two or more indicator sign plates is removably fitted within the frame. A sprocket wheel and chain mechanism leads from the end head of the frame to the under side of the car roof convenient to the operator on the platform.

545,358. TROLLEY CONTROLLER FOR ELECTRIC RAILWAYS; Leonidas W. P. Gray and Philip P. Doescher, New Orleans, La. Filed May 23, 1895. The trolley controller consists of a rope connected to the end of the car and to the trolley pole with an independent rope traversing the top of the car from end to end and carried over pulleys at the ends. The rope is detachably connected at one end to the rope on the trolley pole at the rear end of the car and is carried through the latter longitudinally, its forward end being secured in the reach of the motorman at the forward end of the car. (See Illustration).

545,393. GUARD AND GUIDE FOR ELECTRIC TROLLEYS; John R. Trisler, Westwood, assignor of one half to Joseph H. Moore, Cincinnati, O. Filed June 1, 1895. This is a combined guard and guide for trolleys and is adapted to receive the wire between its upright sides. Both the guard and guide are pivotally supported, one in front and the other behind the trolley and normally are in a position in which the guard is above and the guide below the upper edge of the trolley.



545 358.—TROLLEY CONTROLLER FOR ELECTRIC RAILWAYS.

545,404. ELECTRICALLY OPERATED MINE CAR; Henry B. Dierdorff, Columbus, O. Filed Dec. 24, 1889. This is a mine car with a frame or body formed of separable sections of cast iron, bolted together at points near their ends.

545,427. CAR BRAKE; Frank Henslein, Philadelphia, Pa., assignor of one third to Lizzie I. Hoffman, same place. Filed June 15, 1895. The frame is adapted to be secured to the under side of the car and mounted longitudinally in it is a cog wheel. A pair of diametrically arranged arms project upwardly from the cog wheel and pitmen are connected at the outer ends of the arms. Brake operating shafts are hinged on the front and rear platforms of the car with a flexible connection between the shafts and the pitmen. A pair of horizontally arranged shafts or drums have pinions on their outer ends which mesh with the cog wheel. A block moves in ways in the frame, and chains connect the movable block and the shafts or drums. A pair of levers is pivoted to a stationary block in the frame, having brake shoes secured to their outer ends, rods connecting the movable block and lever, and springs being provided between the stationary and movable block.

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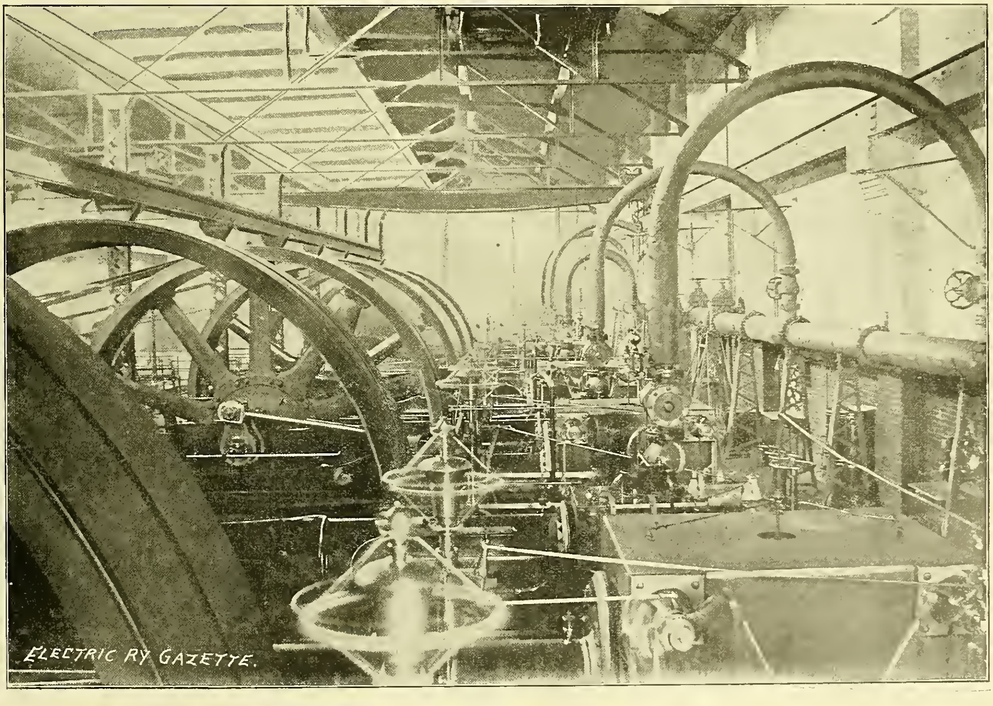
Vol. XIII. NEW YORK, SEPTEMBER 14, 1895. No. 11.

Montreal Street Railways—I.

FROM a street railway point of view Montreal may be considered almost an ideal city. Its transportation system is wonderfully complete and presents many novel points of interest which may be studied with advantage by those who attend the convention of the American Street Railway Association in that city next month. Since the last large electrical convention was held in Montreal in 1891, the transit facilities of the city have been revolutionized. At that time the lines were all operated by horses, the cars were small and had seen their best days, and in every respect the service was poor and inadequate. It was frequently remarked that it was strange that Montreal, so enterprising in many ways, should be content with so wretched a system of street railways. It was then explained that the question of equipping the lines for electric traction had been considered as a doubtful experiment. During the winter months, it was stated, the city was covered by a blanket of snow and ice which made it impossible to operate the horse cars, and sleighs were substituted. It was argued by the conservative street railway men of Montreal that the same conditions would prevent a satisfactory operation of electric roads; for, it was said, it would be found impossible to remove the snow from the tracks, or at least impracticable, because of the vast expense which the work would involve.

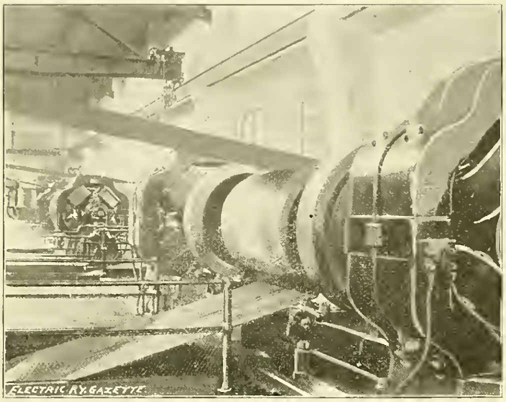
The street railway system subsequently passed into the control of new men who scouted this conservative notion. They proceeded to equip the road in the most substantial manner without any apprehension that the investment would be idle during a considerable part of the year. The result has demonstrated that their confidence was well founded. The lines have been operated without difficulty during the winter months. The expense for the removal of snow has, indeed, been great, but by no means prohibitive. The companies afford splendid facilities for the city the entire year, and the increasing traffic has justified the construction of many important extensions.

The city is well adapted for street railways, as the streets are, for the most part, regularly laid out, and few steep grades are to be encountered. At the present time about 95 miles of track operated by electricity have been laid. The Montreal Street Railway Company, whose system is described herewith, controls 74 miles. Its lines extend through the business and residential districts, and afford rapid transit in all directions. The lines traverse some of the principal thoroughfares, and during the morn-



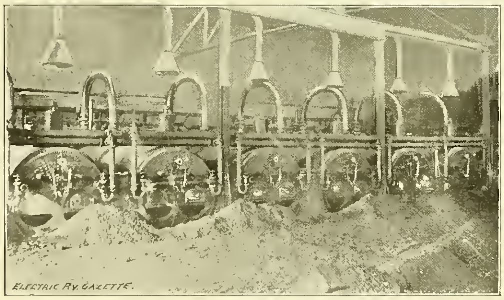
INTERIOR OF WILLIAM STREET POWER STATION.

ing and evening hours, when the traffic is heaviest, cars are run under very short headway. Perhaps the busiest point in the city is the corner of Craig and St. Lawrence Streets, which, it is estimated, 100 cars pass every hour.



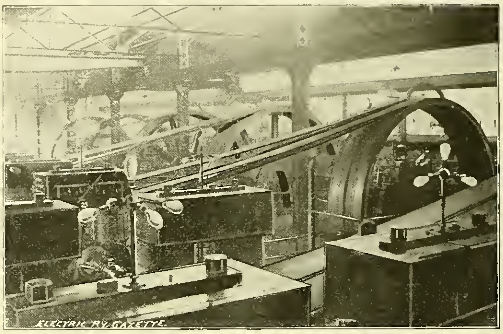
MULTIPOLAR GENERATOR.

The rolling stock of the company consists of 117 motor cars and 119 trailers. The car bodies are of Canadian and American manufacture, and are mounted on Bemis, Brill, and Blackwell trucks. Several different types of motors are employed, and were supplied by the Royal Electric Company, of Montreal, the Westinghouse Company and the Edison Company. The box cars are of different lengths, ranging from 16 to 24 feet, and are tastefully finished and decorated throughout. They are equipped with foot gongs, sand boxes and fenders. During the winter months the cars are equipped with stoves. Several of the fenders are of the Ives type, manufactured in Montreal, while others were designed and built by the company.



BOILER ROOM.

One feature which always attracts the attention of every stranger in Montreal is the method of collecting the fares. The conductors carry fare boxes in which the passengers are required to deposit their money or tickets. The boxes are locked, the keys being kept in the office of the company. The conductors handle no money except when making change. The company at one time experienced some trouble as a result of the dishonesty of some of its employees, who displayed considerable ingenuity in abstracting tickets and money from the boxes. To prevent further tampering, the company now attaches at the bottom of the interior of the fare boxes a small tin receptacle about two inches long and one inch wide, which is filled with shot. Two spouts are attached to the receptacle in such a way that if a fare box is turned upside down, which would be necessary before any of the contents could be abstracted, the shot will run out into the fare box, thus clearly indicating that an effort to tamper with the latter had been made. This method of collecting fares seems on first sight to be cumbersome, awkward and slow, compared with the systems which are in vogue in American cities. In Montreal, however, it is regarded with great favor. It is claimed that the use of a portable fare box has practically eliminated stealing, as with the present arrangement of the fare box, the passenger must be an accomplice if theft is committed. For this reason the system of collecting the fares is maintained, despite what appear to be obvious objections. As an inducement to the employees to attend strictly to their duties and give efficient service, the company donates a prize of $400 every three months, for which all men having clear records are entitled to compete. This plan has been found to work admirably and stimulates the men to stricter attention to duty and to perform more efficient work. As more than one third of the entire population of the city speaks French only, the company makes it a practice to employ only conductors who can converse in French and English. The men are well disciplined and their politeness and civility, and the regard paid to the comfort of passengers, are particularly noticeable on all their lines.

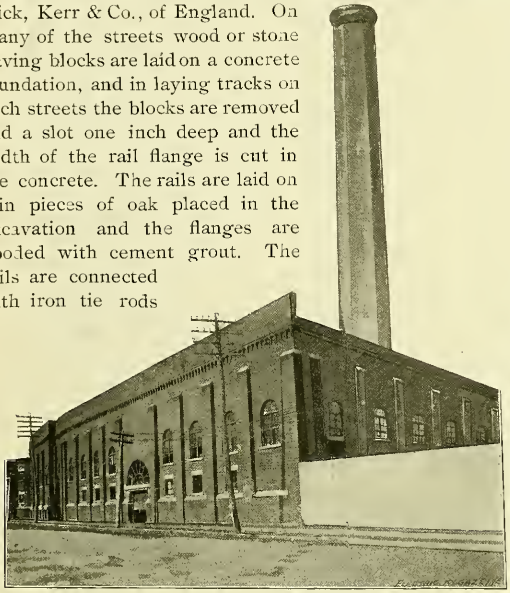


ENGINES AND BIPOLAR GENERATORS.

GRADE ON ST. LAWRENCE STREET.

About 800 men are employed, who work on a 10-hour basis.

The English method of laying girder rails directly on concrete has been followed on most of the lines. The rails are of the grooved girder type, 6½ inches in height, weighing 72 pounds to the yard, and were supplied by Dick, Kerr & Co., of England. On many of the streets wood or stone paving blocks are laid on a concrete foundation, and in laying tracks on such streets the blocks are removed and a slot one inch deep and the width of the rail flange is cut in the concrete. The rails are laid on thin pieces of oak placed in the excavation and the flanges are flooded with cement grout. The rails are connected with iron tie rods and the joints are fastened with six-bolt fish plates. The space on each side of the web is filled with cement grout to the width of the rails and the paving blocks are replaced and the space filled in with grout. This construction has been severely tested by heavy traffic and the joints have stood up well under the strain, notwithstanding the extreme cold during the winter months, when the temperature has fallen to 20 degrees below zero.



WILLIAM STREET POWER STATION.

At crossings and at points where special work is required the rails are spiked directly to cedar ties. A considerable amount of this kind of work has been necessary, and one of the most interesting examples is to be found at the corner of St. Lawrence, Main and St. Catherine Streets. At this point two lines of double track cross each other with double-tracked, right-angled curves connecting each set of main tracks. The girder rail employed in this work is 6½ inches in height and weighs 79 pounds to the yard. The total weight of metal at the crossing aggregates 26 tons, and over 2,000 feet of rail are employed.

The rails are connected with wrought-iron fish plates, and all switch tongues are of hammered steel. The special work was installed by the Canadian Switch Manufacturing Company, and all work of this kind throughout the company's lines has been done in the most thorough manner. The sharpest curves on the road are of 45 feet radius, and the maximum grade is 10 per cent. This steep grade, however, extends for a distance of only 200 feet.

The overhead construction is of a substantial character. Wood and iron poles are employed and No. 00 hard-drawn copper wire is used. Waterproof No. 0000 feed wire is employed and the return feeders are of the same gauge. The rails are bonded with No. 4 wire; the ends of the wire, passing through the web of the rails, are riveted and soldered.

The power station of the company is located at the corner of McCord and William Streets. The building is a substantial structure of brick, with Montreal bluestone trimmings, and has a frontage on William Street of 350 feet. The engine room, the floor of which is elevated about eight feet above the street level, measures 80 x 200 feet. Light and ventilation are afforded by large windows on three sides and by windows in the roof.

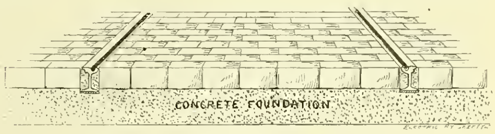
The engine room contains six cross-compound Corliss engines of 600 rated horse-power each, with cylinder dimensions of 24 and 48 inches in diameter, with 48-inch stroke. The fly-wheels, which are 22 feet in diameter, run at a speed of about 70 revolutions per minute. Three of the engines are belted to two General Electric multipolar generators of 300 kw each. Two generators are secured to one bedplate and are coupled together by a friction clutch so that either or both may be operated. The fly-wheels of the remaining three engines are provided with double crowns and each engine is belted to four General Electric bipolar generators of 200 kw each. The belts are 24 inches wide, while those running the larger generators are 54 inches wide.

The condensers are located in the basement beneath the engine room, and are of the Worthington independent type, measuring 15 inches and 12 x 10 inches. The condensing water is taken from the canal, which is in close proximity to the power house. A main 20 inches in diameter provided for this purpose extends through the engine and boiler rooms and has separate connections with each pump.

The switchboard is very ornamental and is located on a gallery at one end of the building. It is about 10 feet in height above the floor of the gallery and extends the entire length of the room. The top of the board is surmounted by an ornamental cornice and the stairways leading to the gallery and the gallery platform are guarded by a handsome brass railing.

The switchboard is built up of hollow terra-cotta bricks and is covered with a coating of adamantine plaster. The instruments are of the standard Westinghouse type, and over each ammeter is an incandescent lamp held in a gooseneck bracket and provided with an ornamental shade, the whole presenting a very attractive appearance.

The steam-generating plant occupies a room 100 x 125 feet, and is equipped with 250 horse-power boilers of the Lancaster type, built by Daniel Adamson, of Manchester, England. Each boiler is provided with a government pop valve, a combined low water and safety valve, and a dead load safety valve.

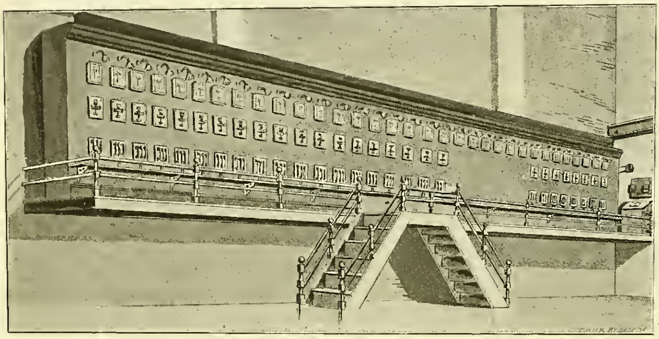


SECTION OF TRACTION CONSTRUCTION.

The valves are designed to carry a working pressure of 125 pounds of steam per square inch, and are built of $\frac{9}{16}$ inch steel plate, with end plates $\frac{11}{16}$ inch in thickness. The transverse seams are double riveted, while the longitudinal seams are quadruple riveted.

A very complete system of steam piping is employed, and the danger of a complete shutdown through accident is reduced to a minimum. Water is supplied to the boilers by Northey pumps, manufactured by the Northey Manufacturing Company, of Toronto. Two separate lines of feed water pipes are provided, and each boiler is connected to each supply pipe, so that in case of accident to one, water may be taken from the other. There is consequently little danger of stoppage on account of the failure of the water supply.

Steam from the boilers passes through six hoop pipes to a main extending the entire length of the room. The main and the elbows are provided with Chapman gate valves, so that if necessary any boiler can be shut off from the main, or a part of the main itself may be cut out. Another steam main is located in the engine room and extends along the wall the entire length of the room, from which steam is taken to the engine through hoop connections seven inches in diameter, like the piping in the boiler room. Valves are located in the main and connections. The whole arrangement is such that any engine may take its steam supply from any boiler. The steam piping throughout is covered with asbestos block covering, and the bent pipes between the boilers and the engines were supplied by John McDougal, of Montreal.



THE SWITCHBOARD.

The gases from the furnaces pass through a Green economizer, made by the Fuel Economizer Company, of Matteawan, N. Y., by which the feed water is raised from 80 to 260 degrees. The gases may also be passed directly to the stack through a by-pass, so that repairs may be made when necessary. The stack is of brick, 190 feet in height, with circular flue nine feet in diameter. The company has several car barns in different parts of the city and a large and well-equipped repair shop at the corner of Cote and Vitre Streets. The shop is completely equipped with modern machine tools and appliances for making all repairs. The equipment of the machine shop includes lathes, planers, engine lathes, single and gang drills, shapers, milling machine and emery grinders. The road is also fully equipped with snow sweepers, snow plows and extension tower wagons.

(*To be continued.*)

Continuous Gong Ringing.

The village Council of Carthage, O., recently passed an ordinance requiring motormen to sound their gongs continuously in the village streets. After the regulation had been in force a week the residents unanimously protested against it, and the measure will probably be annulled.

Ottawa Electric Railways.

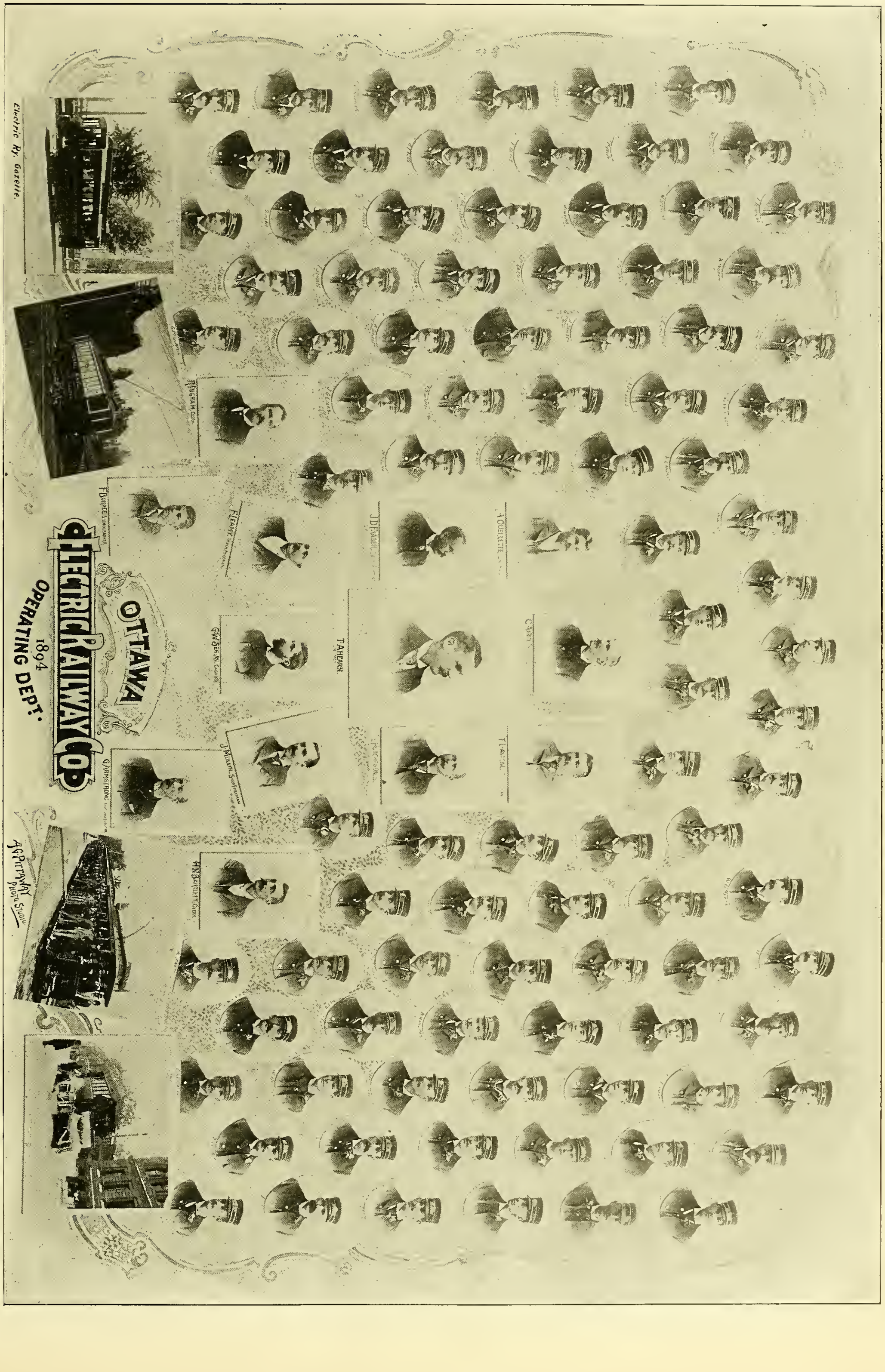
It is the proud boast of the people of Ottawa that their street railway system stands second to none in America, both in point of equipment and in operation. The citizens take a great interest in this road; when an Ottawa man goes abroad he forms his opinion of a street car service by comparing it to that of his native place as a standard of excellence.

The street railway interests of Ottawa are controlled by one company. The cars are operated entirely by electricity by the overhead trolley system, and the service is, beyond question, a good one; the roadbed is smooth and the cars are roomy and comfortable; they are pleasantly warmed in Winter by electric heaters concealed under the seats; they ride easy, are kept neat and clean, and the conductors and motormen are well dressed and well disciplined. The cars go everywhere and everybody rides.

The layout of the road is well planned. The different lines spread themselves over every part of the city; they extend to the outlying parks and villages and to the Government experimental farm. The residential district, lying between the Rideau River and the canal, is served by the St. Patrick Street line and the Theodore and Rideau Streets loop line; the Elgin Street line extends direct from the heart of the city to the Canada Atlantic Railway depot, while the Wellington and Albert Streets lines lead to the Canada Pacific depot, the large lumber and manufacturing district situated on the several islands at the Chaudière Falls and to the town of Hull on the opposite side of the Ottawa River, in the Province of Quebec. The Bank Street line extends to Lansdowne Park and Exhibition Grounds, a distance of about two miles from Sparks Street, and the Somerset Street line is now being extended to the Government experimental farm, a distance of three and one third miles from Sparks Street.

Rideau Hall, the official residence of the governor-general of the Dominion, and Rockliffe Park are reached over the Sussex Street line, passing through the old municipality of New Edinburgh. Sparks Street is the very centre of the business portion of the city and all the lines converge there. This arrangement undoubtedly encourages travel; many of our larger railway companies would profit by rearranging their car service as much as possible according to this plan.

Rockliffe Park is a most delightful place for recreation, situated as it is amongst primeval pines on the high bank of the Ottawa River on the Ontario side, about three miles below the main part of the city. From Rideau Hall outward the railway company has a private roadway winding through beautiful woods along the bank of the river. The company has for the last three summers been running this park as a pleasure ground and find it a fruitful source of revenue. It has a merry-go-round and other attractions, including bands, in operation every evening and Saturday afternoons during the warm weather. The private roadway and the park are brilliantly lighted with arc and incandescent lights, supplied with current from the railway circuit, and the power required to drive the merry-go-round and other apparatus is taken from the same


Electric Ry. Gazette.
OTTAWA
ELECTRIC RAILWAY CO.
1894
OPERATING DEPT.
R. INGRAM, Gen.
F. BURPEE, Sec-Treas.
F. LEAMY
J. D. FRASER
A. OUELLETTE
G. W. SEFTON, Cashier
T. AHEARN
J. MULLEN, Shop Foreman
G. ARMSTRONG
H. N. BARTLETT, Clerk
A. G. PITTAWAY PHOTO. STUDIO

source. The spacious club house of the Ottawa Canoe Club, lying just below the park, is also lighted by electricity. A very ingenious boat elevator, driven by an electric motor, is here used. The apparatus was devised by Mr. A. A. Dion, who is a prominent member of the club and superintendent of the Ottawa Electric Light Company. It is similar in construction to the ordinary electric elevator machinery, and cuts off the current automatically when the boat carriage arrives at the top or bottom of the slide.

The Ottawa Electric Railway Company is not an old corporation. In 1890 the City Council granted Messrs. Ahearn and Soper a franchise for operating an electric road. They organized the Ottawa Electric Street Railway Company, which was incorporated early in 1891 with an authorized capital stock of $1,000,000, and in June of that year the road was opened for traffic. The Ottawa City Passenger Railway Company, incorporated in 1865, had been in operation since 1870. In 1893 these two companies joined hands, adopting the name which they now carry. They hold a Dominion charter, and is the only street railway company in Canada having this. The present paid-up stock of the company is $814,800, with no bonds or other indebtedness outstanding. The officers are J. W. McRae, president; Warren Y. Soper, vice-president; T. Ahearn, managing director; J. D. Fraser, secretary-treasurer, and J. E. Hutcheson, superintendent. The directors are J. W. McRae, T. Ahearn, G. P. Brophy, T. Workman, P. Whelen, Wm. Scott, Warren Y. Soper. The company is working under an agreement with the city of Ottawa for a term of 30 years from Aug. 13, 1893, whereby it pays the city an annual stipulation of $450 per mile of street covered by its tracks, during the first 15 years of the agreement, and $500 per mile during the balance of the term; it is not required to pay the city a percentage of its receipts, and is exempt from all taxes, except on real estate. Further, the company agrees to remove all snow from the streets occupied by its tracks, and the city keeps the streets permanently in repair.

Power Plant.—The motive power used is entirely a water power, the plant being located on Victoria Island, at the Chaudière Falls, where a head of 19 feet is secured. The actual fall of the water at this point is about 26 feet, but since the river is subject to heavy freshets, the turbines must be placed above the high-water mark to avoid drowning. Four 66-inch turbines, built by Wm. Kennedy & Sons, of Owen Sound, and one of the same size built at the Victoria Foundry, Ottawa, each rated at 500 hp, drive the generators which supply current to the line. The jack and counter shafts are located in the basement, while the three large dynamos are on the ground floor, which covers an area of 50 feet by 95 feet. There are two countershafts, four turbines being belted to one, driving two 400-hp Westinghouse generators, and the remaining two to the other, which drives one 700-hp Westinghouse generator. Hill clutches are used on the countershafts and applied in such a way that the dynamos and turbines belted to the same shaft can be cross-connected as desired. A somewhat novel arrangement of governing is employed, the field coils of the generators being separately excited. For this purpose a separate dynamo of the old U. S. type, driven by an independent turbine is used to supply current to the three sets of field coils, arranged in parallel, at a pressure of 500 volts, and the fields are thus kept at a constant initial magnetization. To compensate for the armature reactions, a certain number of fixed coils in series therewith are of course employed. The gates of the turbines driving the generators are operated by hand, while that of the turbine driving the exciter is controlled by a Fruen mechanical governor. The method is found to work exceedingly well, the E. M. F. on the line being maintained at a variation of only five per cent., and a number of other important advantages secured. Though Mr. Ahearn does not claim to be the original inventor of this method, although he did devise and work it out independently, it is the first instance of its kind of which the writer has any knowledge.

The station is well protected from lightning, six Keystone and 18 non-arcing arresters being attached to the lines. In addition to these a water resistance is tapped across all the feeders as they leave the switchboard. Three impedance coils are inserted in each feeder, and three sets of leads can be taken from behind these into a tank of flowing water which is well grounded.

As a safeguard to be used in case the operator should lose control of the turbine gates, a coil of one mile of No. 6 iron wire is kept submerged in the river. This is connected to an ordinary street car controller, and the gate operator can thus throwany part of this load on the machines. The power house is under the able superintendence of Mr. T. Lavigne.

Road and Equipment.—The road extends over 17 miles of streets, nearly all of it being double-tracked. There are 29 miles of track; 40-pound T-rails were used at first, but in all the later work 52-pound girder rails and 72-pound high T-rails are put down on the main business streets, and 56-pound T-rails on the outlying districts. Ties are set 2 feet 6 inches between centres, and angle fish plates are used. Bonding is done with No. 00 copper wire, cross-bonded every 200 feet and connected at intervals to the water mains; where the tracks pass the power house, six No. 0000 copper wires are taken from the rails to the negative leads on the station switchboard. A point worthy of note is that trouble with telephone interference has been fully avoided by putting up a large number of copper aerial return wires in addition to the ordinary returns. These lines are distributed to tap the rails at different points of the city, and vary in size from No. 0000 to No. 2.

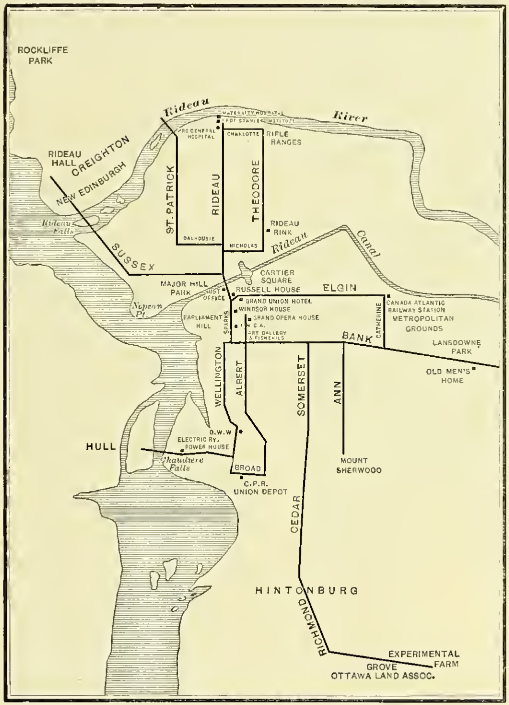
No. 0 hard-drawn trolley wire is generally used, though No. 00 is being put up now on new work; the lines are well supplied with feeders and the available potential is practically the same at all points.

The rolling stock consists of 39 closed vestibule cars, 28 open cars, three mail cars, five snow sweepers and three "walkaway" plows. The first cars used were built by Messrs. Patterson & Corbin, of St. Catherines, Ont.; later ones are all of the Ottawa Car Company's make. Westinghouse double equipments are used throughout. The company claims the honor of having been the first to successfully get rid of snow—and in Ottawa they have a superabundance of that commodity. When snow begins to fall the sweepers are put on immediately; these are followed by the "walkaway" plows, which shovel the snow to the side of the roadway. It is then carted away by horses. During the four years the road has been in operation the cars have not lost a single trip on this account.

The car sheds, of which there are three, are located on Albert Street, each building being sixty-six feet by two hundred feet, built of brick, with iron trussed roofs. The repair shops and a very commodious suite of offices are situated in one of these buildings.

The company transports all mail matter between the post office and railway depots and carries the city letter carriers, under agreement with the Dominion Government. This service was begun in October, 1893, and was the first of its kind on this continent, as is now well known.

The company estimates that it supplies a population of 70,000 persons—50,000 in the city of Ottawa, 13,000 in Hull, Quebec, and 7,000 from the surrounding villages. During its existence the traffic has been enormously increased. The total receipts of the old horse car company never exceeded $26,000 per annum; in 1891 the total receipts of the new electric road, which had then just begun operations, were $71,698, while the total receipts of the amalgamated companies for the year ending May 31, 1895, were augmented to the considerable sum of $193,991.



Electric Railway Gazette

MAP SHOWING ROUTES OF ELECTRIC RAILWAYS IN OTTAWA.

When we consider that electric cars were first operated in Ottawa in June, 1891, and that with the extensions put in this season there will be 29 miles of rapid transit tracks covering its principal thoroughfares, we may form some idea of the phenomenal development in street railway matters which has been wrought by electrical science, and it becomes evident that the "deadly trolley" is, after all, an institution of some considerable benefit and comfort to humanity.

Practical Notes for Motormen—XIV.

BY GEORGE T. HANCHETT.

Sparking at the Commutator.—Sparking at the brushes of a railway motor is a very common occurrence and is always more or less destructive to the commutator. In most railway motors the brushes are rigidly set and admit of no ready adjustment except that of pressure on the commutator. The brush is usually a broad thick block of carbon bearing radially on the commutator and held on by spring pressure.

There are in general but three kinds of sparks that appear on any direct-current commutator, and in general are due to three separate causes. The three kinds of sparks are as follows:

1. Sparking due to imperfect contact.
2. Sparking due to improper commutation.
3. Sparking due to jumping segments.

The first of these is the most likely to occur on a railway motor and therefore will be first considered. The spark due to imperfect contact may be recognized by its color and nature. It is of a reddish-yellow color and when aggravated is inclined to throw out dart-like sparks in every direction. The imperfect contact may be caused in a number of ways. First, the commutator may be dirty. This is most often the case. Carbon dust and oil are likely to accumulate on its surface and soon produce a rough, uneven surface, making contact between bars where no contact should be, and tending to make contact at the brushes faulty where it should be the best. The cure is to keep the commutator clean. It does not take very much time to lift the trap doors, open the commutator lids and wipe off the commutator with a clean cotton cloth. This may be done when traffic is a little slack, and if done even once or twice a day, will add months or even years to the life of the commutator. In order to prevent the dirt as much as possible, use a brush that has been boiled in vaseline. This will tend less to produce powder, and will largely do away with the disagreeable screeching noise that carbon brushes often emit. Such a brush should be self-lubricating and should not need any other oil. Oil should never be put on in large quantities on a commutator. The slightest amount is sufficient. A drop may be placed on the finger, wiped off in the palm of the hand and then the finger applied to the commutator; this will give ample lubrication. The imperfect contact may also be due to ragged contact surface of the brush. It may not bear squarely on the commutator, but rather on one corner. Inspection should detect this, and it may then be readily corrected.

Carbon brushes may be conveniently fitted to the surface of a commutator by lifting the brush and placing a strip of medium sand paper under it. By allowing the brush to spring down against the sand paper and moving the sand paper to and fro using the commutator as a guide, the brush will be ground to quite an accurate fit. The rough edges must then be beveled off and the copper coating trimmed back one fourth of an inch or so.

Imperfect contact may be caused by insufficient spring pressure. The jarring of the equipment and any roughness of the commutator may cause the brush to jump and spark.

High and low bars in the commutator are liable to occur and produce intermittent sparking which keeps step with the revolution of the armature. The only effective remedy for this is to tighten the commutator motor bolts and turn down the commutator. The sparking may be partially abated if the fault is a high bar by locating the bar, filing it down as nearly as may be and finishing by sand papering the whole commutator. For a low bar there is no remedy.

Sparking at the commutator is also produced by an entirely different source and wholly electrical in its nature; that of improper commutation. If the student will return to some of the windings that have been depicted in previous sections, he will note that bridging the gap between the commutator bars is a coil of wire which is wound about the iron core of the armature. This coil varies in its shape and position according to the winding employed, but the principle of commutation remains the same. A bobbin to be properly commutated should be swung up to the brush till it is entirely empty of E. M. F. and then received under the brush, being thus short circuited. It should be held thus short circuited till it has swung far enough into the reverse field to generate a current in it of the same direction and strength of the section of the armature which it will join when it leaves the short circuiting brush. Usually a few instants of short circuiting produce the necessary current in the bobbin. The bobbin is of low resistance, and the field is strong. A fraction of a volt is all that is needed. A properly commutated bobbin will not spark; an imperfectly commutated bobbin gives a bluish spark at the brushes, quite different from a spark due to poor contact. In order to properly commutate, two things are necessary: 1st, the brush must be in the right position; 2d, the brush must be thick enough to hold the bobbin short circuited the proper length of time.

The advantage of having coils of equal resistance and shape is now readily seen, for the proper conditions to commutate one of the bobbins commutates all of them. Otherwise some general average of condition must be used.

Unfortunately, however well a motor be designed, the proper position of the brushes varies with the load. In a railway motor the latter constantly varies, and it would be impracticable, if not impossible, to constantly shift the brushes to the best position. Consequently they are firmly bolted in one position, which is found to give the best all around results. Almost all that a motorman or conductor can do is to keep the commutator clean and take what comes. There is a variety of intermittent sparking that is due to a local defect in the armature. A short-circuited or partially short-circuited bobbin will produce an intermittent spark. An open-circuited bobbin will produce very heavy flashing sparks which will often travel completely around the commutator. Either of these sparks may be detected by its burning the particular bar at which it occurs.

When a field coil is cut out by short circuiting it sometimes throws the field out of balance. This will produce a sparking, curable only by repairing the field coil.

The third kind of sparking occurs on the surface of the commutator and not at the brushes at all. Its cause is a dirty commutator; its remedy a clean one. It may be well to add in behalf of station managers that a different setting of brushes for the cars on crowded city lines where the motors are largely in series will produce good results. Determine which setting is best for motors in series and which for motors in multiple and adjust the brushes of the city motors for series and those of the suburban motors for multiple.

(*To be continued.*)

Philadelphia Consolidated Company.

A certificate of incorporation has been issued for the Union Traction Company, of Philadelphia, into which the Philadelphia, the People's and Electric Traction Company are to be merged. The capital stock is placed at $100,000, but it will be increased by a vote of the stockholders to $30,000,000. Soon after the capital is increased to the full amount it is expected that notices will be issued requesting shareholders of the People's and Electric Traction Companies to deposit their stock with the Pennsylvania Company, the trustee, and receive in exchange the 4 per cent. trust certificates. On Sept. 26 the stockholders of the People's Traction Company will meet and vote on the proposed reduction of the capital of the company from $10,000,000 to $6,000,000, by making the par value of the shares $30, the amount now paid in, instead of $50. The stockholders of the Philadelphia Traction Company will meet also on Sept. 26, and act on the proposed lease to the Union Traction Company. Proxies more than sufficient to assure favorable action have been on hand for some time. The only person who has been mentioned for president of the new company is John Lowber Welsh, president of the People's Traction Company.

Protection of Grade Crossings.

At the request of the Michigan Board of Railway Commissioners, representatives of steam railways and electric railways met in Detroit last week, to consider the best methods of protecting grade crossings. It was the general opinion that the presence of a flagman did not constitute sufficient protection for the companies or the public. It was thought advisable by most of those present that gongs and danger signals should be used, and that derailing switches should be installed by the street railways. Engineers Moore, superintendent of the state railway department, Miles, of the Michigan Central, and Wilson, of the Grand Trunk, were appointed a committee to get up plans for such safety appliances, and will report at a meeting to be called by Commissioner Billings.

Joint Use of Tracks.

The Supreme Court of Louisiana has recently handed down a decision regarding the joint use of tracks on a street. It states that "railways with franchises to use the same street may be required to use one track, and in the exercise of this power a company may acquire the right to use the tracks laid down by another, but compensation for such use must be made. If the tracks thus subjected to the common use of the two companies are unfitted by age, long use or other cause, to serve the purpose of these companies, an action may be maintained by one against the other to compel the repair or reconstruction of the tracks at the joint expense of the companies."

Excursion Car "Defender."

The Philadelphia Traction Company has completed the second car built expressly for trolley parties, and it is already in demand. It is named "Defender," and the decorations and hangings of china silk, as well as the numerous electric lights, are pink and white. In the first of these cars, the "Trilby," the colors of the decorations are green and white. The car is very long and has two trucks. Both cars are carpeted and have cane seats.

Street Railway Engineers—XX.

G. W. PALMER, JR.

G. W. Palmer, Jr., electrician of the Globe Street Railway Company, of Fall River, Mass., entered the electrical field after a successful career on shipboard. He was born and educated in Fall River, and determined to follow in the footsteps of several members of his family, who had been shipmasters. In 1879 he shipped before the mast as a green hand. He made many voyages to South America, West Indies, East Indies, China and Japan. Promotion was rapid, and he successively filled the positions of boatswain and third officer. He was second officer of the East India clipper ship *Sea Witch* at the time of her memorable collision with the British gunboat *Sirius* in the Java Sea. He was chief officer of the ship *John Brightman* on a voyage to South America in 1884, when, as a consequence of the death of the captain, the command of the ship devolved upon him, when he was 23 years of age. The ship was short-handed, only three men fit for duty, but he took her into Demerara. He now holds a master's certificate.

G. W. PALMER, JR.

His first connection with electrical business interests was with the Edison Company in Fall River in 1885. Later he was employed by the old New England Edison Wiring Company (afterward the New England Wiring & Construction Company) at Brockton; the company was installing interior wiring [for the Brockton Electric Company, of which Mr. W. J. Jenks, now patent expert of the General Electric Company, was manager. Mr. Jenks operated in that city the first three-wire underground system ever installed. Here Mr. Palmer first saw an electric motor. Frank J. Sprague, then expert for the Edison Company, was engaged in special work in Brockton, and at the same time was experimenting with the electric motor which was subsequently known by his name. Mr. Palmer was next engaged by the Edison Company at Lawrence, Mass., and then accepted a position as electrician of the Edison Company at New Bedford, Mass., where he had the entire supervision of all electrical work, including interior wiring, line construction and underground work. He also installed the Edison chemical meters.

In 1886 he accepted a position with the Marr Construction Company, then installing Edison central station plants through the State of Pennsylvania. He assisted in the installations at Reading, Scranton and Wilkes Barre, and had charge of the work at the Norristown operating plant until it was turned over to the local company. Subsequently he took the position of assistant superintendent and electrician of the Wilkes Barre Electric Light Company, having charge of the incandescent department. While at Wilkes Barre, on account of his wide experience in all practical details of central station construction and operation, he was selected by J. A. Vail, then chief engineer of the Edison Company, to supervise the reconstruction of the Edison plants at Brockton and install the Edison municipal system of street lighting. When the rebuilding of the station was completed nothing remained of the former structure but a small portion of the walls, and every engine and generator had been removed to a new position. When current was turned on the municipal system, it was regarded as the best example of incandescent street lighting in the country, and attracted many visitors who were interested in this line of work. The credit for the complete working out of details was due to W. J. Jenks, then manager of the municipal department of the parent Edison company. After completing the reconstruction Mr. Palmer operated the plant for a year and then accepted the position of manager of the McKeesport (Pa.) Light Company. During his management the notable suit of the Westinghouse Electric Company against the McKeesport Light Company was tried in Pittsburg before Justice Bradley, of the United States Supreme Court, resulting in a verdict for the McKeesport company.

Severe illness, brought on by overwork and exposure incident to the reconstruction of the plant, compelled him to return home to Fall River to recuperate. At his recovery, after a two years' illness, he was engaged by the Globe Street Railway Company as electrical engineer, which position he now holds. This company is said to have one of the best constructed and operated systems in New England. Mr. Palmer supervises all electrical equipment, construction and repairs. He is frequently called in for consultation on the electrical problems attending the construction of the Dartmouth & Westport Railway between Fall River and New Bedford. Mr. Palmer has succeeded in his field as a consequence of perseverance and strict attention to detail.

Kingsbridge Franchise Approved.

Contrary to general expectation, Mayor Strong, of New York, this week signed the Kingsbridge Railway franchise given by the Board of Aldermen to the Third Avenue Railway Line. This ends a fight that has been carried on for over six months. The franchise covers 15 miles of streets, and was petitioned for by both the Metropolitan and Third Avenue companies.

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ELECTRIC TRACTION TESTS AT NANTASKET.

In another column will be found an account of some tests recently made with motor cars on the Nantasket Beach branch of the New York, New Haven & Hartford Railway Company. These tests, while of undoubted value to non-technical railway managers, have not demonstrated any new facts to electrical engineers. It is a comparatively easy matter to design an electric car equipment which shall develop any desired draw-bar pull within the limits of the running gear, and propel a given car or train at any desired speed, without the necessity of resorting to "cut and try" methods. At the same time it appears to be difficult to convince non-electrical railway men of this fact, the somewhat childish motto, "Seeing is believing," apparently being their creed. In view of this condition of affairs a practical demonstration, such as that referred to, is certainly beneficial to the cause of heavy electric traction. Another fruitful source of misguided discussion and needless speculation is the rate of speed, which the mere electrical equipment of a car is generally supposed to render practical. The fact is that the speed limit is fixed chiefly by the track and truck construction, which the electrical equipment obviously does not affect; the type of current-collecting device employed also has some influence upon the speed limit, but the adaptation of the trolley to high speeds is a purely mechanical matter and is not to be considered in any sense a serious problem.

ELECTRIC TRACTION FOR THE BROOKLYN BRIDGE

It was Prof. Elihu Thomson, we believe, who once stated that it was always a matter of regret with him that the railway on the New York & Brooklyn Bridge was not operated by electricity. The conditions for successful operation were, he said, ideal, and an installation in this the most prominent position in the country would serve greatly to stimulate electric traction. This remark was made in the early days of the electric railway, when it was necessary that its meritorious features should be advertised. The announcement, however, that the bridge trustees are considering the advisability of substituting electricity for the cable will be almost as gratifying to the electrical fraternity to-day as it would have been six years ago. At the last meeting the preliminary step was taken. The trustees adopted a resolution referring to the chief engineer the question of using electricity on the bridge, and instructing him to secure, as soon as possible, plans and specifications for the work. Certainly now is an admirable time for making the change. The new terminal stations are now in process of construction, and if the new motive power is to be introduced they should be completed with that fact in mind. There can be no doubt that the substitution of electricity would be a vast improvement on the system now in use. In the first place the switching could be done more speedily, for it would be no longer necessary to employ locomotives for this purpose. Trains can be operated at a higher speed, if it is considered safe, on the bridge structure. Then the absence of smoke and cinders in the terminals will be appreciated by the traveling public. The fact that cars may be more quickly switched to the platforms will be an advantage which will especially commend itself to the approval of the Brooklynites. In the month of July the number of passengers who rode on the bridge averaged 119,000 daily, and during the busy hours it was found simply impossible to accommodate the traffic. The service will be vastly improved when the terminals afford better switching facilities, but even then the demand cannot be met during the rush hours unless the railway is improved by the adoption of electric power. Now that the trustees have determined to consider the matter seriously, we cannot doubt what the conclusion will be. The railway will be electrically equipped and will be one of the most interesting installations in the country.

TWO CANADIAN RAILWAY SYSTEMS.

We publish elsewhere in this issue descriptions of two of the most interesting street railway systems in Canada—those of Montreal and Ottawa. The articles are timely, as all those who attend the next convention of the American Street Railway Convention will have an opportunity to inspect the system of the former city, and many will avail themselves of the opportunity to visit Ottawa, which may be reached in less than four hours. In previous numbers we have alluded to the interesting features of the Montreal system. Novelties in the construction and operation of the line may be studied to advantage by those who will be in attendance at the convention. The projectors of the Ottawa electric railway performed some significant pioneer work in the field of traction in Canada. Before the installation of the road in that city there was a very general belief that the operation of electric railways was scarcely practicable in Canadian districts where so much snow was to be encountered. It was thought that the expense of clearing a path for the cars would be so great that the financial success of an electric railway would be problematical at the best. The projectors of the Ottawa system had an abundant faith in the possibilities of electric traction, even under the most adverse conditions, and the result has demonstrated that their confidence was well founded. The snow problem was solved satisfactorily, and recent reports in our financial columns have shown that the road is a money-making enterprise. This fortunate result naturally served greatly to stimulate projects of this kind in the Dominion. The fact that at the presenttime a great variety of traction enterprises is under consideration may doubtless be regarded as the necessary consequence of this satisfactory operation of this pioneer Canadian railway. Another fact serves to make the Ottawa installation of special interest to enterprising Canadians. Power is furnished by a waterfall, and current is generated economically. Water power is available in a vast number of places in Quebec and Ontario, and that it will be utilized to a much greater extent within the next few years may now be safely predicted. The Ottawa company has been singularly successful in overcoming the difficulties incident to the use of turbines for driving electric generators in a railway plant. The methods by which close regulation is secured now seems to leave little to be desired. Those who are contemplating the use of water power in a railway power station should not fail to plan a visit to Ottawa at the close of the Montreal convention. They will be afforded facilities for inspecting a plant of this kind which operates more successfully and satisfactorily, perhaps, than any similar station on the continent.

Proposed Subway for Chicago.

It is announced by a Chicago paper that a gigantic deal is under consideration to provide a subway for surface railway travel in that city. It is stated that an ordinance will be introduced in the city council providing for a complete system of subways, on the arcade plan, traversing streets and alleys on the South side between Twelfth Street and the river, and between Clinton, on the West side, and Lake Michigan. Boston and Philadelphia capitalists are said to have joined with leading Chicago financiers to make the enterprise successful. It is asserted that $500,000 in cash will be deposited with a Chicago trust company by Oct. 1, for the preliminary expenses of the company.

This project is supplementary to the union elevated loop, and according to its promoters, some of the same capitalists interested in the loop have agreed to join in making the subway project a success. The union loop will take care of elevated traffic only. The subways are for the use of the surface roads, and if the plans of the promoters are carried out, there will not be a cable, electric or horse car line on the streets between Twelfth Street and the river within five years.

The plan is to provide subways for the use of all surface lines entering the business portion of the city. The ordinance of the company will provide that the motive power in the subways shall be electricity, and that the lighting, ventilation and other accessories shall be perfect.

The ordinance for the subway company will provide that construction shall be begun within one year from the passage of the measure, and that the whole system shall be completed within five years. The city will be given the right to purchase the entire property at a valuation after 30 years, or one year after the payment of the first mortgage bonds of the company.

Underground Electric Railway in Berlin.

Siemens & Halske have been granted a concession for an electric railway, to be built for carrying passengers to Treptow Park, in Berlin, where the Berlin Exhibition is to be held next year. The line will commence in the central part of Berlin, in Behrenstrasse, and in the central district of the city will be underground. A large space in the exhibit hall will be devoted to the electrical department.

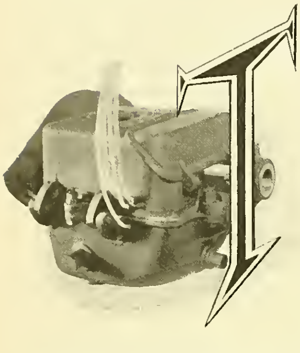
Electric Car Tests.

BY HERMANN S. HERING, M.E.,
Assisted by
CHARLES REUTLINGER and B. HARRISON BRANCH.

III.—SPECIAL CAR TESTS.

(*Continued from page 159.*)

Pikesville Road. First Test.



THIS test was made for the purpose of determining the performance of a car over the entire car route with no other car on the road at the time, in order to determine the speed, current drop in voltage and horse-power on the various portions of the road, and also the characteristic operation. If other cars had been on the road at the time the variation f the potential difference would have been much greater, and the drop from the power station to the car could not have been determined. This road has already been described,* and this first test was made while the road was entirely single track, and the second was made after a portion of it had been double tracked. The cars used in both tests were unfortunately not the same ones, but they were as nearly identical as it was possible for two cars to be, and for all practicable purposes it will be sufficient to consider them as the same; the main difference was in the division of the current between the two motors when in parallel, and there was also a very slight difference in the traction coefficient. The same motorman operated the cars in both tests, and otherwise conditions were practically alike.

The car was equipped with a tachometer belted to the car axle from which the speed could be read at any instant; a Weston ammeter was placed in the trolley circuit which measured the total amount of current supplied to the car, and another one in series with one of the motors; and a Weston voltmeter was connected between the trolley and the "ground" of the motors, thus measuring the total applied potential difference. The time was measured by means of a chronometer, and the values were determined within a quarter of a second. A Weston voltmeter was also placed on the switchboard at the power station for the purpose of measuring the potential difference there simultaneously with the readings taken on the car. When the motors were running in series these ammeters read alike, and were thus frequently checked up, but when the motors were in parallel, the difference between the ammeters gave the value of the current in the motor which had no ammeter.

The test was made in the early morning before the regular operation of the cars began. Readings were taken at the instant the cars passed each pole on the road, the poles having all been previously numbered and also located on charts. An observer was stationed on the front platform to give the signal at the instant the car passed the poles, a certain alignment between the car and the pole enabling this to be done with accuracy. The exact time of passing the pole was read by means of the chronometer. The car was run on what is known as "express" time, which is normal speed with no stops nor unavoidable delays. This character of run was adopted in order to eliminate the variations introduced by stopping. The weight of the load on the car was maintained constant.

The values of the results obtained on the trip from Baltimore to Pikesville are plotted in Fig. 14, and the return trip from Pikesville to Baltimore in Fig. 15. The plot is made on a distance base, and all the results obtained are plotted on the corresponding points on the road where the readings were taken. The various values for any portion of the road can therefore readily be obtained by following up the vertical line passing through that portion. The difference between the two volt curves when no current is used by the motors is the drop due to the current supplying the lamps on the car, which varies from

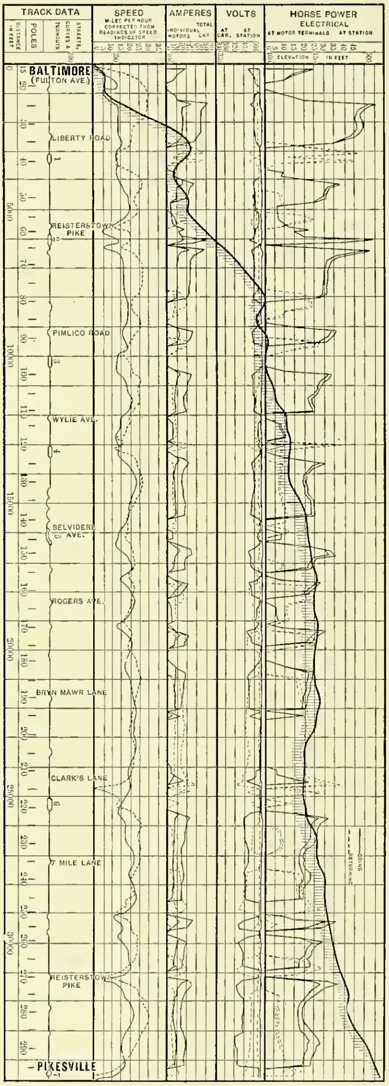


FIG. 16.—COMPARISON OF GOING AND RETURN TRIPS. SPECIAL CAR TEST, PIKESVILLE ROAD, JUNE 21, 1893.
(*Figs. 14 and 15 superimposed*)

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* See Electric Railway Gazette, Aug. 31, 1895, p. 133.

one half to one and one half volts, but is slightly exaggerated in the diagram.

A test and plot of a similar character, made by the author in conjunction with a former colleague, Prof. Wm. S. Aldrich, was given in *The Electrical World*, July 23, 1892, pp. 55 and 56, comprising a portion of the series of articles on the "Test of the Neversink Mountain Electric Road." This plot was, however, on a time base, but the readings were not made with as great a frequency as in the Pikesville test, owing to a scarcity of observers.

TABLE III.—CAR AND ROUTE DATA OF SPECIAL CAR TESTS.

Cars run over entire route; no other cars on road at the time.

Car Equipments: No. 233, two 25-hp Westinghouse S. R. motors, G. controllers, single truck, Bemis; No. 234 same; No. 64, two 25-hp G. E. 800 motors. K. controllers, single truck, Lord Baltimore No. 2.

Route and car performance plotted on a distance base in Figs. 12 to 24.

TEST NUMBER.			I			II			III			IV		
ROUTE.			BALTIMORE and PIKESVILLE.			BALTIMORE and PIKESVILLE.			ROLAND PARK and CITY HALL.			ROLAND PARK and LAKESIDE.		
PORTION OF ROAD TESTED.			Between poles 15 and 297 (Old numbers)			Between poles 15 and 319 (New numbers)			Between poles 144 and 586			Between poles 145 and 240		
DATE OF TEST.			June 21st 1893, 4.23 AM			June 8th 1894, 3.55 AM			June 13th 1894, 3.51 AM			June 13th 1894, 4.46 AM		
CAR NUMBER.			233			234			64			64		
DIRECTION.			Going	Returning	Round Trip	Going	Returning	Round Trip	Going	Returning	Round Trip	Going	Returning	Round Trip
ROAD DATA. LENGTH.	Length of Road tested, in feet.	1	34399	34399	68798	34399	34399	68798	26329	26329	52658	10946	10946	21892
	" " " in miles.	2	6.52	6.52	13.04	6.52	6.52	13.04	4.99	4.99	9.98	2.073	2.073	4.146
	" " Single Track, in feet.	3	34399	34399	68798	10942	10942	21884	0	0	0	0	0	0
	" " Double "	4	0	0	0	23457	23457	23457	26329	26329	26329	10946	10946	10946
	Double Track, percentage of total,	5	0	0	0	68	68	68	100	100	100	100	100	100
	Number of turnouts.	6	7	7	14	3	3	0	0	0	0	0	0	0
	" " crossovers.	7	0	0	0	4	4	8	4	4	8	1	1	2
CURVATURE.	Straight track, length in feet.	8	29124	29124	58248	28666.6	28666.6	57373.2	23314	23465	46779	7343	7343	14686
	Curved " "	9	5275	5275	10,550	5712.4	5712.4	11424.8	3015	2864	5879	3603	3603	7206
	Straight track, percent of total.	10	84.7	84.7	84.7	83.4	83.4	83.4	88.5	89.2	88.6	67.1	67.1	67.1
	Curved " "	11	15.3	15.3	15.3	16.6	16.6	16.6	11.5	10.8	11.4	32.9	32.9	32.9
	Number of Curves, Simple.	12	15	15	30	14	14	28	23	21	44	12	12	24
	" " " Compound,	13	4	4	8	7	7	14	0	0	0	0	0	0
	" " " Total.	14	19	19	38	21	21	42	23	21	44	12	12	24
	Sharpest Curve, in degrees, or rad.	15	34°8′ 112°56′ 34°8′	same.	same	26°16′ 60°0′ 26°16′	same	same	45 ft. or 180 rad.	same.	same	17°46′	17°48′	17°48′
	" " length in feet.	16	200	200	200	171.2	171.2	171.2	71	71	71	339	339	339
	Longest Curve, in degrees, or rad.	17	2°0′–2°12′ 2°0′–2°12′ 3°50′	same.	same.	2°12′–2°0′ 2°12′–3°50′	same.	same	3°0′	3°0′	3°0′	14°	14°	14°
	" " length in feet.	18	1900	1900	1900	1439.5	1439.5	1439.5	1001	1001	1001	58	58	58
	Average Curvature, excluding str't. track	19	23°16′	23°18′	23°18′	12°59.3′	12°59.3′	12°59.3′	22°10′	22°10′	22°10′	10°24′	10°24′	10°24′
GRADE.	Difference in level between ends of road	20	+286.0 ft.	−286.0	0	+286.0	−286.0	0	−359.3	+359.3	0	−89.7	+89.7	0
	Mean Grade, percent. (Diff. in level ÷ length.)	21	+.83	−.83	0	+.83	−.83	0	−1.365	+1.365	0	−.82	+.82	0
	Level Track, length in feet.	22	0	0	0	615	615	615	1360	1360	2720	0	0	0
	" " percent of total length	23	0	0	0	1.8	1.8	1.8	5.2	5.2	5.2	0	0	0
	Ascending Grades, length in feet	24	23799	10600	34399	23841	9943	33784	6069	18900	24969	3905	7041	10946
	" " percent total length	25	69.2	30.8	100	69.3	28.9	98.2	23.0	71.8	94.8	35.7	64.3	100
	Descending " length in feet.	26	10600	23799	34399	9943	23841	33784	18900	6069	24969	7041	3905	10946
	" " percent total length.	27	30.8	69.2	100	28.9	69.3	98.2	71.8	23.0	94.8	64.3	35.7	100
	Mean Ascending Grade, percent	28	1.50	.68	1.25	1.45	.61	1.20	2.04	2.55	2.42	2.64	2.74	2.70
	" Descending " "	29	.68	1.50	1.25	.61	1.45	1.20	2.55	2.04	2.42	2.74	2.64	2.70
	Steepest Ascending " "	30	5.96	3.19	5.96	5.95	3.19	5.96	7.5	8.2	8.2	6.47	6.58	6.56
	" " length in feet.	31	744	383	744	744	383	744	229	254	254	362	342	342
	Longest Ascending Grade, percent.	32	2.4 (avg)	.87 (avg)	2.4	2.4 (avg)	.87 (avg)	2.4	2.38	1.45	1.45	•1.98	4.07	4.07
	" " " length.	33	3200	1800	3200	3200	1800	3200	1190	2284	2284	1136	3745	3745
CAR-LIFT.	Total Car-lift in feet.	34	358	72	430	347	61	408	123.7	483.0	606.7	103.0	192.7	295.7
	Total Car-drop "	35	72	358	430	61	347	408	483.0	123.7	606.7	192.7	103.0	295.7
RESULTS OF TEST. LOAD.	Weight of Car, actual, in lbs.	36	15694	15694	15694	15798	15798	15798	14710	14710	14710	14710	14710	14710
	Number of passengers and crew.	37	9	9	9	12	12	12	12	12	12	11	11	11
	Total weight of car and load.	38	16973	16973	16973	17313	17313	17313	16215	16215	16215	16065	16065	16065
STOPS.	Number of Stops, including 1 terminal	39	1	2	3	1	1	2	4	4	3	1	1	2
TIME.	Net time-interval of trip.	40	26m 17s	21m 12s	47m 29s	23m 15s	18m 25s	41m 40s	26m 40s	25m 45s	52m 25s	6m 50s	7m 17s	14m 7s
SPEED.	Mean Speed, from time-interval, m.p.h.	41	14.9	18.4	16.7	16.8	21.2	19.0	11.8	12.8	12.9	18.2	17.1	17.6
	" " integrated, miles per hr.	42	16.5	20.1	18.3	17.3	22.6	20.0	12.6	13.7	13.2	17.8	16.9	17.3
AMPERES.	Mean Amperes over entire road. integrated	43	24.7	12.3	18.5	33.4	19.4	26.4	13.0	39.6	26.3	26.2	37.7	31.9
	" " portion using power. integrated	44	38.6	22.8	31.3	33.6	23.9	29.1	28.8	45.8	40.0	43.8	56.0	50.3
VOLTS.	Mean Station Volts during test. integrated	45	515	512	513.5	481	473	477	514	517	515	514	514 •	514
	" " " time power was off	46	513	510	511.5	480	470	475	513	515	514	512	512 •	512
	" " " time power was on.	47	516	514	515	481	474	477.5	516	518	517	515	515 •	515
	Mean Car Volts over entire road. integrated	48	484	490	487	448	450	449	510	505	507	497	490	493
	" " portion using power. integrated	49	468	473	470	447	446	446.5	507	504	505	487	479	483
	Mean drop in volts over entire road	50	31	22	26.5	33	23	28	4	12	8	17	24 •	20
	" " " portion using power	51	48	41	45	34	26	31	9	14	12	28	36 •	32
WATT-HOURS.	Watt-hours used during test. (From Wattmeter)	52	—	—	—	6890	3160	10050	3200	8370	11570	1784	2850	4634
	" " per car-mile.	53	—	—	—	1056	485	771	642	1675	1159	861	1375	1118
E.H.P.	Mean Station E.H.P. during test, integrated	54	16.7	8.7	12.7	21.7	12.5	17.1	8.9	27.5	18.2	18.2	26.0 •	22.1
	" " " time power was used (int.)	55	26.1	16.1	21.5	22.0	15.3	19.0	19.7	31.8	27.7	30.4	38.6 •	34.8
	Mean Car E.H.P. over entire road.	56	15.2	7.7	11.5	20.1	11.6	15.8	8.7	28.6	17.6	17.0	23.8	20.4
	" " portion using power	57	23.8	14.2	19.5	20.3	14.3	17.6	19.2	30.7	26.8	28.4	35.4	32.1
	E.H.P. lost in line during time power was used	58	2.3	1.9	2.0	1.7	1.0	1.4	.5	1.1	.9	2.0	3.2 •	2.7
	" " " percent Station E.H.P.	59	8.8	11.8	9.3	7.7	6.5	7.3	2.5	3.5	3.2	6.6	8.3 •	7.8
SUNDRY.	Mean line resistance, in ohms.	60	1.3	1.8	1.4	1.0	1.2	1.1	.32	.31	.30	.64	.64 •	.63
	Portion of road power was used. Percent of total length	61	64	54	59	98.9	81.2	90.0	45.2	86.5	65.8	59.8	67.3	63.5

Explanatory.—Tests I and II were made under maximum speed, and the cars handled by same motorman.

Test I was made when the road was single-tracked and II when it was partly double-tracked and the curves rebuilt for high speed.

Test III was made at ordinary speed, and Test IV at somewhat above the average.

Readings of instruments were taken at every pole, and the means determined by integrating the plots.

Pole 319 in Test II corresponds to pole 297 in Test I.

Cars 233 and 234 were identical in construction, equipment and age.

Results marked (*) were calculated on the assumption that the line resistance was the same as "going."

A dash (——) means no date determined.

The lower portion of the plot in Figs. 14 and 15 contain the track data, comprising a scale of distances in feet, the poles, the location of the streets, curves and turnouts, as well as some of the principal stations. The straight portion of the track is represented by straight lines, and the curved portion by curved lines plotted to their true length, their degree of curvature being given in figures placed alongside. The direction of the curve, whether right-handed or left-handed, is indicated by the arcs being drawn in such a way as to suggest this direction when reading the diagram from left to right. The numerical values concerning these special car tests, namely, the road data and results of tests, are given in Table No. III. and will be referred to later on.

The trolley wire and feeders and their connections are shown diagrammatically, the dotted lines representing the trolley, which is a No. 4 phosphor-bronze wire, and the taps with the feeders by vertical lines. Where these lines are not connected with the feeders a cross-over is shown; otherwise wherever these lines cross the feeders a tap is made. The speed is plotted in miles per hour from the indicator readings taken at every pole. The profile of the road is indicated by the cross-hatched line across the figure, the elevations in feet being given in a scale on the left. The plot of the amperes shows the value of the total current as well as of the individual motors, the solid line representing the motor No. 1 in whose circuit the ammeter was placed and the dotted line the value obtained from the difference of the two ammeters or of motor No. 2. It will be seen that the motors were operated sometimes in series and sometimes in parallel, and that the motor No. 2 almost always took more current than No. 1. This difference was determined more carefully, and the results will be given later on. The plot of the volts shows the value at the car and at the power station, and also the drop along the line. The readings of the volts at the station were taken throughout the tests at intervals of five seconds and were subsequently plotted on a time base; and as the time of passing the poles was determined, these poles were also plotted on the same time base. The value of the volts at the station could therefore be obtained from the value determined by the location of these poles on this auxiliary volt curve. The readings of the volts at the car were taken at every pole, and, consequently, the simultaneous value of the volts at the car and at the station were thus obtained.

From the drop in voltage along the line and the current the resistance of the line was computed at every pole for the entire road, except when no current was used. The loss in horse-power along the line was also computed from these figures, and plotted with the horse-power curve. The electrical horse-power at the station and at the car was calculated for every pole, and plotted as shown. The component mechanical horse-powers of the car, namely, the "lift" horse-power, "traction" horse-power, and the "acceleration" horse-power, were also calculated for every pole and plotted. These component mechanical horse-powers have already been explained and the method of computing them given.*

The value of the lift horse-power above the zero line represents the work done "up grade," and that given below zero, a negative value, is the "car-drop" horse-power, and represents the value when the car is going "down grade." The plot of the acceleration horse-power below the zero is a negative acceleration or a retardation, and represents the value when the car is slowing up. When this curve coincides with the zero line there is no acceleration, and the speed is, consequently, uniform. The algebraic sum of these values gives the mechanical horse-power at the car axle unless the speed of the car is very great, in which case the wind resistance becomes an important factor. The relative variation of these curves and a comparison with the

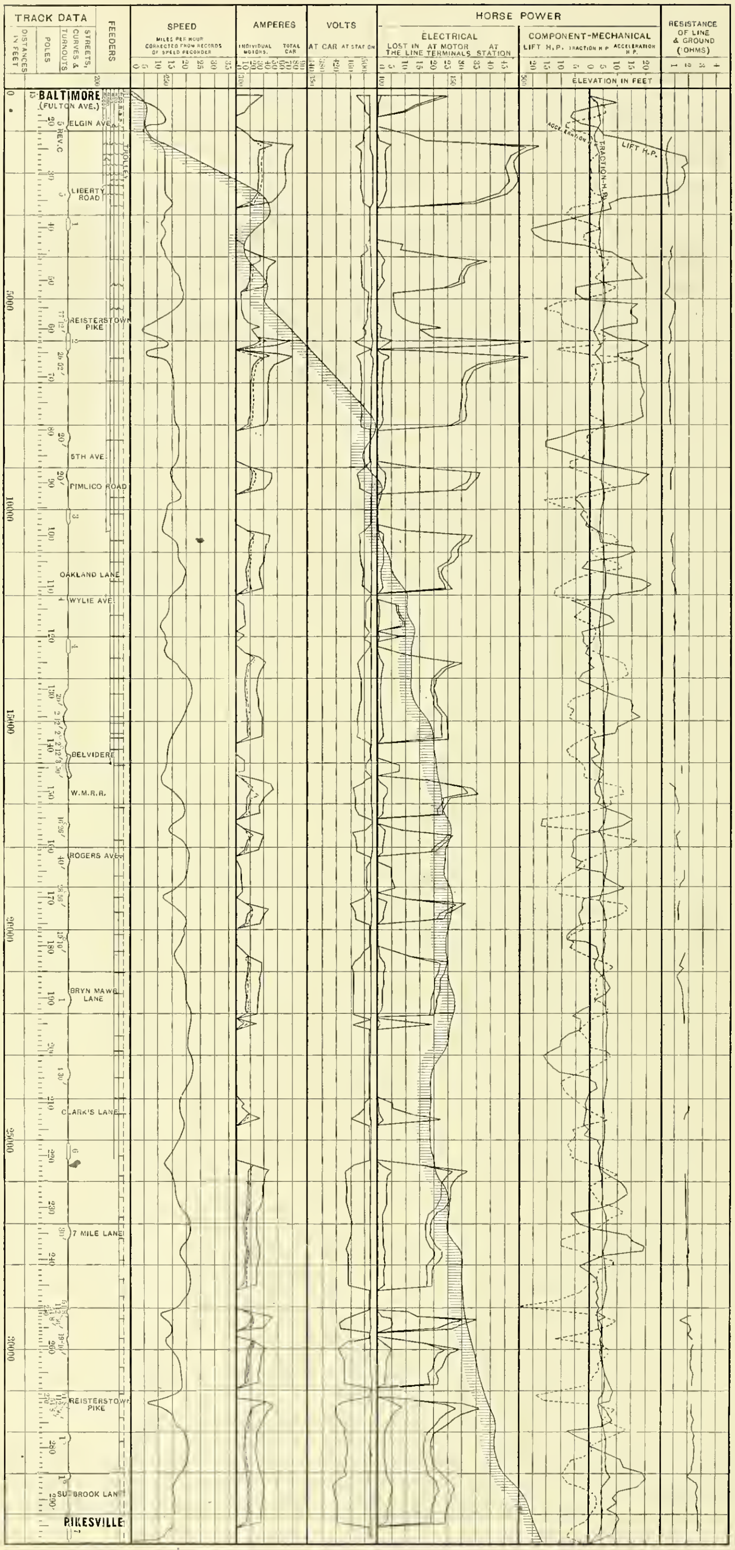

FIG. 14.—CAR AND ROUTE DATA OF SPECIAL CAR TEST, PIKESVILLE ROAD, JUNE 21, 1893.

Car 233 run over entire route; no other car on the road at the time. Car equipped with two No. 3 Westinghouse S. R. 25-hp motors and G. controllers. Weight of car and load 16,973 pounds actual. Plotted on a distance base of electric car route. A—Baltimore to Pikesville.

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*See Electric Railway Gazette, Sept. 7, 1895, p. 157.

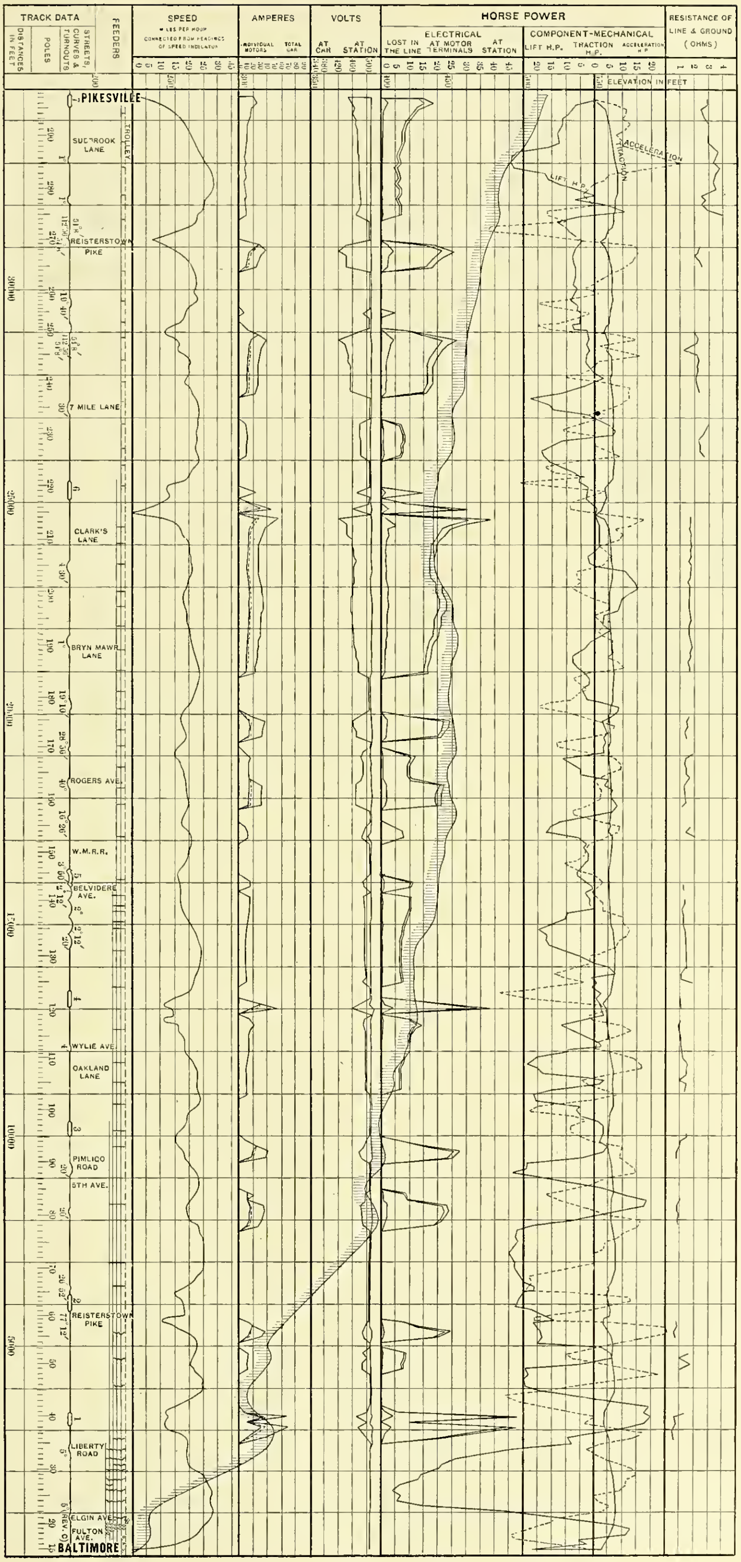


FIG. 15.—CAR AND ROUTE DATA OF SPECIAL CAR TEST, PIKESVILLE ROAD, JUNE 21, 1893

Car 233 ran over the entire route; no other car on the road at the time. Car equipped with two No. 3 Westinghouse S. R. 25-hp motors and G. controllers. Weight of car and load 16,973 pounds actual. B—Pikesville to Baltimore.

curves on the return trip are very interesting and show what an important factor the acceleration and lift horse-power are. Allusion has already been made to the difference between the curves of this road and of the Lake Roland road, where the acceleration is much more variable. It should be borne in mind, however, that this is strictly a suburban road, and the speed is very high at times, and fairly regular throughout when compared with the Lake Roland road, which will be given later on to illustrate this feature.

Table III. contains a summary of the results obtained from these special car tests, and much interesting data can be obtained by careful inspection. The table contains the mean values for each half trip and also for the round trip. The curves in the diagrams were all integrated and the means obtained in that way, but the mean speed was calculated from the time interval and the distance, as well as from the integration of the speed record. These two values are different, because the record is plotted on a distance base, and as this base is variable in a speed curve the integration contains two variables, and, therefore, is not strictly correct, though the error is not great. The integrated value, however, gives a more correct result of the average running speed, as the mean speed from the time interval contains errors in starting and stopping. Both values, however, are given throughout all the tests, and either can be used by the reader.

In order to facilitate the comparison of the results of the outgoing and return trips, some of the records in Fig. 15 were superimposed upon those of Fig. 14 in such a manner that the profiles coincide; thus the difference in speed, current, volts and power on the outgoing and return trips can readily be seen. Fig. 16 contains these double curves, those for the return trip being given in dotted lines. The curves of the outgoing trip, from Baltimore to Pikesville, should be read from left to right, and those of the return trip, from right to left, the relative direction of the running of the car during these trips. The reason why considerable power is used on the return trip, compared with the trip going out, is that the down grade for three quarters of the distance is very slight, having a drop of only about 100 feet in four and one-half miles, and thus requiring power almost continuously, and only at the Baltimore end of the road, where the greatest drop takes place, is there little or no power used.

(*To be continued.*)

Electric Locomotive Tests.

An important series of tests was made at Nantasket Beach on Tuesday last to determine the efficiency of the electric cars as freight locomotives and their practical speed limit in express and passenger service.

The first test was made with the two-motor car No. 2503, which was coupled to nine cars, the combined weight of which (including freight) was 302 tons. The test was not entirely successful, and the cars were dropped, one at a time, until the number was reduced to five, which the motor car drew fairly well.

A test was then made with the four-motor car No. 2500, which was weighted with 5,000 pounds of iron for ballast and attached to seven carloads of granite, weighing 243 tons. This load was moved very easily. Then the weight of the train was increased to eight cars and 273 tons, and subsequently to nine cars and 302 tons, which were hauled with the same ease as was the lighter load.

The ballast on the motor car was doubled, making a load of 10,000 pounds, and 10 carloads of freight, weighing 335 tons, all of which was easily pulled. Twelve carloads, weighing 400 tons, were as easily handled, but with 14 carloads, weighing 470 tons, the train moved slowly. The power shown by the motor car in this last test was equal to that of a 42-ton locomotive.

The two-motor cars were then coupled together and attached successively to 18, 21, 25 and 30 cars, carrying respectively, 608, 714, 833 and 954 tons, all of which loads were easily handled. During this test something gave out on the four-motor car, and the entire load was moved by the two-motor car. The two-motor car was then attached to six cars, carrying 215 tons, and carried them to Nantasket yard.

At this point tests were made with the open motor-cars. One of the motors in open car No. 2514 was cut out, and with a single motor it easily hauled a carload of 39 tons to the power station and return. Two cars of 40 tons apiece were also hauled with the same ease.

At the conclusion of these tests an open car was taken out and a run made to Pemberton. On the run down a speed of 58 miles per hour was attained; on the return the car was said to have reached a speed of 72 miles an hour, but this was doubtless overestimated.

The Second Washington-Baltimore Road.

It has been announced by Frank C. Drane, general manager of the Washington, Sandy Springs & Baltimore Railway Company, that a survey of his company's proposed line has been completed. This road, if built, will make the second electric line between Baltimore and Washington.

Comments and Views of Contemporaries.

ELECTRICITY ON ELEVATED RAILWAYS.—Perhaps some day, a few decades hence, the elevated railway managers will discover that their cheerless, ill-lighted and overcrowded cars can be run by electricity.—*New York Herald.*

LIGHT RAILWAYS.—The solution of the "light railway" question in Great Britain would seem to lie in the construction of trolley lines similar in most points to American branch railways. Instances beyond number are already to be quoted of advantageous results obtained by the introduction of such lines running either along the highways, or on their own land. That steam cannot possibly compete on equal terms would seem to be fully demonstrated.—*London Electrical Review.*

CABLE SYSTEM ON THE BROOKLYN BRIDGE.—The affection of the trustees for the old cable system which the rapid development of electric power has now made antiquated, does more credit to their heart than their heads, and this new resolution indicates that they are beginning to think so themselves. It is the second step in the progress of bridge accommodation, the full measure of which will be apparent only when it is a part of the rapid transit system of the two cities.—*Brooklyn Citizen.*

ELECTRICITY ON THE MANHATTAN.—If surface roads can find it profitable to re-lay their whole roadbed and change their entire rolling stock to adapt it to electricity, why cannot the Manhattan Elevated Railway show equal enterprise and good sense? The elevated structure could be fitted with a conductor at a comparatively trifling cost, and, as it would always be accessible for repairs, it would be certain in its operation. The coal-burning locomotives on the elevated roads are nuisances, and their use should be forbidden by the Board of Health.—*New York Herald.*

BLOCKADING CARS.—There is no justice in allowing a coal wagon to obstruct the traffic of a busy street, and when such obstruction is made unlawful with an effective penalty attached it will be found to be entirely unnecessary. That is to say, when the coal dealers are compelled to keep the surface tracks clear of obstruction it will be a very simple matter to construct delivery wagons and carts that can be unloaded without interfering with the passage of the surface cars. We are not sure that an ordinance regulating the length of the chute wagons used for delivering coal would not be the most direct way of putting an end to the coal wagon blockade. If the average chute wagons now in use were shortened one foot the cars could pass without difficulty. It would be very easy to construct shorter wagons. The loss in the length of the wagon body could be made good by an increase in height or width so that the carrying capacity would remain the same.—*Philadelphia Times.*

ELECTRIC RAILWAYS FOR MARYLAND.—The idea of utilizing electricity to supply means for local transportation has taken a strong hold upon the people of Maryland. In parts of the State farmers, fruit-growers and quarrymen are remote from the railways, and are practically without facilities for sending produce quickly to the market. Within a brief period these people have seen the city of Baltimore leap suddenly forward a quarter of a century through the agency of rapid transit. Before their astonished gaze the problem of connecting the business centre with the distant suburbs has been worked out, whereby the value of property is enhanced, and the circle of possible residence for city people vastly widened. They have seen popular resorts spring up 10 miles from the city, inviting crowds daily to the enjoyment of cool breezes and delightful shade. Moreover, this spectacle has created a profound impression upon practical men in the counties, and they have begun to ask why electric railways running along the turnpikes should not do for rural communities what they have done for the territory immediately surrounding Baltimore.—*American Engineer.*

Birmingham Accumulator Traction.—At the meeting of the shareholders of the Birmingham Central Tramways Company last year the then chairman spoke of the accumulator car venture of that company as one of "mingled difficulty and hope," and went on to say that he had "distinct reason to believe that the electric department had seen its worst days"; a very restrained dose of prophecy for a chairman, seeing that a *bona-fide* profit of over £1,200 had actually been earned by accumulator cars for the first time in history. The circumspection exhibited by Mr. Ebbsmith has, however, been thoroughly justified. His successor had this year to chronicle a loss of £1,735, not attributable, of course, to the system of traction adopted, but to the bad weather, fire at terminus, and keen omnibus competition, a dismal tale which concluded in the customary manner, "they were hopeful that this branch would soon earn a profit," and "they had made a very favorable contract for the supply of batteries." It is very evident that accumulator traction still remains a tangle of hopes and difficulties, the former being served out to investors, the latter being left to engineers to solve—if they can.—*London Electrician.*

Against Municipal Ownership.

C. L. Bonney, of the Chicago General Street Railway Company, recently stated to a reporter that his observations while abroad had caused him to change his views respecting municipal ownership of railways of which he had been an advocate. He said: "In all cities the police regulate traffic, and they do it well. When they say a thing there is no disputing their authority. If they make a complaint that a horse is unfit for service, the horse is used no more. Although I was inclined to be in favor of government ownership of railways when I left, I have changed my ideas. I do not believe it would be a good thing for any country because it would do away with competition."

The Use of Tracks by Vehicles.

Mention was recently made of the fact that the Chicago General Street Railway Company was unsuccessful in its application for an injunction restraining the Chicago City Railway Company from interfering with it if it ran cars on the latter's tracks. The former company, it will be remembered, was unable to secure a right of way by which its cars could proceed to the business district of Chicago, and therefore hit upon the theory that the streets belonged to the public, and that it could, therefore, run its cars anywhere on the public thoroughfares, even upon tracks belonging to another company despite the latter's protest. The courts promptly refused to sustain this contention. The company now announces its purpose to act upon a corollary of the theory. It claims if its cars cannot run on the tracks of another company, then no other vehicles can run upon its tracks. It proposes to institute a suit against the owner of a traffic wagon found using its rails, in order to determine if a trespass is not being committed.

Improved Norton Switchboard Instruments.

The accompanying engravings show the latest product of Charles E. Norton, of Manchester, Conn., in the way of switchboard instruments. The instrument illustrated is an ammeter, and though the general appearance will be familiar to most readers, the instrument has been much improved as to its interior construction.

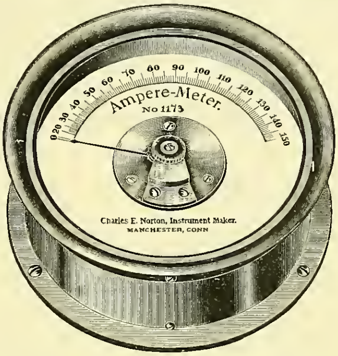


FIG. 1.—NORTON AMMETER

Both the ammeter and voltmeter are sufficiently accurate for the practical work for which they were designed, and the manufacturer claims for them great durability and reliability. The voltmeter is so constructed that the scale divisions are the widest in the region of the E. M. F. at which the line is worked, and it may be left in circuit indefinitely without fear of overheating or having its accuracy impaired. These instruments are mounted in handsomely lacquered brass cases, of substantial construction, and are furnished with either regular binding posts or back connections, the latter type being shown in Fig. 2. As will be seen from inspection of the cut, the back connections are unusually massive, so as to avoid heating and ohmic losses due to poor contact or insufficient cross-section. Another advantage embodied in the type of connection used consists in making the connecting lugs separable from the conducting rods leading into the instrument.

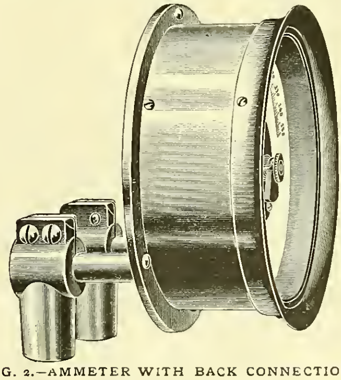


FIG. 2.—AMMETER WITH BACK CONNECTIONS.

FINANCIAL NOTES.

PHILADELPHIA HESTONVILLE EARNINGS.—For the first week in September the Hestonville, Fairmount & Mantua Passenger Railway Company, of Philadelphia, reports an increase in gross earnings over the same week last year of $5,297.

YOUNGSTOWN, O.—It is announced that the Park & Falls Electric Railway Company will increase its capital stock from $50,000 to $200,000. A large force of men will be put to work on an electric road to the coal fields, eight miles south of the city. This field is said to contain 5,000 acres of coal land and has all been quietly tied up by the company and its friends and the work of developing will be commenced at once. The railway company has ordered eight motors, each guaranteed to haul 100 tons of coal on cars eight miles an hour, and 100 gondolas. It has closed contracts to furnish local dealers about 1,000 tons of coal a day beginning Nov. 1.

ATLANTIC CITY, N. J.—In response to the demand that the Camden & Atlantic Railway Company pave one half of Atlantic Avenue in return for the valuable street railway franchise given them several years ago, Superintendent A. O. Dayton, acting for the company, has made the following proposition: "If the city of Atlantic City, within the present year, will arrange and contract for the paving of Atlantic Avenue between Maryland and Missouri Avenues, at a cost not exceeding $100,000, and will issue bonds for the cost, bearing four and one-half per cent. interest, the Camden & Atlantic Railway Company will agree to pay the interest on $40,000 worth of such bonds, and will provide a sinking fund to redeem said $40,000 worth of bonds on or before maturity. The Camden & Atlantic Railway Company will further agree to pay forty per cent. of the cost of keeping said paved portion of Atlantic Avenue in repair."

SCRANTON TRACTION.—The management of the Scranton Traction Company has evoked much favorable comment by reason of its detailed publication of operations, wherein operating expenses are plainly set forth as well as gross and net earnings. For the month of August the showing of the company is as follows:

Items.	1895.	1894.		
Gross earnings....	$28,959.36	$23,392.16	Inc............	$5,567.20
Op. expenses............	14,162.97	14,151.09	Inc.....	11.88
Net earnings..............	$14,796.39	$9,241.07	Inc...........	$5,555.32

For the two months from July 1, *i. e.*, July and August, this statement is made:

Items.	1895.	1894.		
Gross earnings....	$57,257.91	$48,428.47	Inc...........	$8,829.44
Op. expenses..............	27,318.74	27,815.47	Dec...........	496.73
Net earnings..............	$29,939.17	$20,613.00	Inc..........	$9,326.17

MILWAUKEE RECEIVERSHIP.—Receiver Henry C. Payne states that the receivership of the Milwaukee Street Railway Company will terminate within the next 60 days. Mr. Payne says that within the last three months the increase in the business of the road has been something enormous, especially on the lines to the public parks, and that during the receivership he has expended $80,000 in improving and extending the road. "Notwithstanding the outlay," he says, "the road is in good financial condition, and is making money." This is the first time that Mr. Payne has ever admitted the road has made money. From another source it is learned that the bonded indebtedness of the road, which amounts to $12,685,000, of which there is outstanding $11,681,000, will be scaled down about one third, or to about $8,000,000. It is claimed that the road can be made to pay a fair dividend on this amount. At the time the road was placed in the receiver's hands one of the causes assigned for the necessity of the move was the hostility of the Common Council to the interests of the street railway company. The company claimed that proposed legislation adverse to its interests made it impossible for the company to borrow the money to pay the fixed charges of the line. The cause does not seem to be removed as yet. The ordinance granting ex-Congressman McGann a franchise is still pending in the Council, and three of the five members of the railway committee are in favor of its passage.

OPERATING EXPENSES.—The Philadelphia *Stockholder* presents the appended figures, showing the gross and net earnings and percentages of operating expenses of 15 electric railways. The following are for the period from Jan. 1 to July 31: Buffalo (N. Y.) Railway, gross, $947,063; net, $448,770; operating expenses, per cent., .526. Columbus (O.) Street Railway, gross, $353,276; net, $176,074; operating expenses, per cent., .501. Lehigh (Hazelton, Pa.) Traction, gross, $66,220; net, $23,498; operating expenses, per cent., .645. Paterson (N. J.) Railway, gross, $162,216; net, $64,530; operating expenses, per cent., .602. Scranton (Pa.) Traction, gross, $159,066; net, $69,498; operating expenses, per cent., .563. Bridgeport (Conn.) Traction, gross, $163,683; net, $74,993; operating expenses, per cent., .541. The following are for the six months ending June 30: Worcester (Mass.) Traction, gross, $196,644; net, $55,982; operating expenses, per cent., .71. City Electric (Rome, Ga.), gross, $6,747; net $2,077; operating expenses, per cent., .69. Wilkesbarre & Wyoming (Pa.) Traction, gross, $188,234; net, $89,987; operating expenses, per cent., .52. Louisville (Ky.) Railway, gross, $597,043; net, $279,855; operating expenses, per cent., .53. Lynn-Boston (Mass.), gross, $601,788; net, $198,802; operating expenses, per cent., .669. New Orleans (La.) Traction, gross, $641,360; net, $280,868; operating expenses, per cent., .562. Reading (Pa.) Traction, gross, $79,161; net, $29,191; operating expenses, per cent., .631. Troy City (N. Y.) Railway, gross, $222,827; net, $107,618; operating expenses, per cent., .517.

NEWS OF THE WEEK.

CAMDEN, ME.—It is proposed to extend the electric road to Belfast next year.

MEADVILLE, PA.—Meadville is desirous of having an electric street railway.

KANSAS CITY, MO.—Edmund Verstraete is equipping the cars of the Kansas City & Independence line with his electric brake.

ASHLAND MASS.—The town of Ashland has granted the franchise for an electric road between Framingham and Holliston.

JACKSONVILLE, FLA.—Work on the electric road from Jacksonville to Tampa will be commenced some time next month.

NORWALK, O.—It is reported that the Sandusky, Milan & Norwalk electric railways will change ownership within the next few days.

MANCHESTER, CONN.—Work on the new power house of the Hartford & Manchester Street Railway Company has been commenced.

CANTON, O.—The Canton & Wooster Railway Company will build a road between Canton and Massillon, which will be electrically equipped.

HARRISBURG, PA.—The Cumberland Valley Traction Company is pushing the work on its lines to New Cumberland, Boiling Springs and Carlisle, Pa.

KEENE, N. H.—The Keene Electric Railway Company has authorized a committee to contract for the construction of an electric system in this place.

BENNINGTON, VT.—The Bennington & Woodford Electric Railway Company has applied to the trustees of the village for right to extend its tracks through Main Street.

LOS ANGELES, CAL.—D. M. McGarry has made application to the Board of Public Works for a franchise for a street railway to be known as the Los Angeles Belt Railway.

RICHMOND, VA.—An ordinance has been passed authorizing the Richmond Traction Company to construct and operate a street railway within the limits of the city of Richmond.

HAMILTON, ONT.—The Hamilton, Grimsby & Brice Electric Railway Company is having difficulty in getting sufficient power to run its trains between Grimsby and this city.

DETROIT, MICH.—A trolley party has been arranged on the lines of the Detroit Railway Company as a means of raising money for the striking cigarmakers. Thirty cars will be operated.

PHILADELPHIA, PA.—The officials of the People's Traction Company contemplate establishing an extensive park at Willow Grove, to which and through which the company's tracks will be laid.

POTTSVILLE, PA.—Dallas Sanders, president of the Schuylkill Traction Company, has decided against the construction of an electric railway from Shenandoah to Ringtown, because of the great expense entailed.

BINGHAMTON, N. Y.—A company of capitalists has offered to pay $5,000 per mile for a franchise to construct and operate an electric railway, 12 miles long, in competition with the Scranton Traction Company's roads.

PETERSBURG, VA.—The Board of Supervisors of Chesterfield County has awarded the right of way to run an electric line from Manchester to Petersburg to a company represented by John Robertson, of Manchester.

MERIDEN, CONN.—The electric railway managers of Meriden have just granted a voluntary increase of pay to the motormen and conductors in their employ. The old rate was 17 cents an hour; the new rate is 18½ cents.

JAMESTOWN, N. Y.—City Clerk Barker has received a letter from J. A. Lowery, of Utica, asking if there was room in Jamestown for another line of street cars. Mr. Lowery wants to put in two miles of track this season.

OWOSSO, MICH.—Alexander Ralph, who recently purchased the Owosso & Corunna Street Railway, is making arrangements to equip the road with electricity. He says he hopes to have electric cars in operation before Winter.

WELLAND, ONT.—Mr. Fraser, engineer and manager of the Toronto suburban electric railways, has been in Welland, with a view to getting information regarding the proposed electric railway between Welland and Fonthill.

LONG BRANCH, N. J.—Application has been made to the Long Branch Commissioners by the Atlantic Coast Electric Railway Company for the location of its tracks within the corporate limits of Long Branch. R. Blodgett is president.

HAVERSTRAW, N. Y.—A. A. Forman, president of the Haverstraw Gas Company, is the prime mover in a scheme to connect Haverstraw and Garnerville with a trolley road to be eventually extended to Stony Point and Tompkins Cove.

DETROIT, MICH.—The Township Board of Grosse Point, a suburb of Detroit, has granted to the Detroit Suburban Railway Company, 12 Woodward Avenue, Detroit, a franchise for 30 years to construct, equip and operate an electric railway.

BROOKLYN, N. Y.—At a meeting of the bridge trustees on Monday a resolution that the question of employing electric power to propel and switch the trains, in place of the steam locomotives now in use, be inquired into by the engineer, was adopted.

URBANA, O.—The City Council has granted the right of way to the Springfield Street Railway Company to enter the city. It has also passed an ordinance granting right of way to enter the city, to a similar road, to be built between here and Mechanicsburg.

NEW ORLEANS, LA.—The linemen of the New Orleans Traction Company struck a few days ago because one of their number had been discharged. They failed to induce motormen and conductors to leave their positions and a new force was secured without trouble.

BUFFALO, N. Y.—The Buffalo, Gardenville & Ebenezer Railway Company has applied to the State Railway Commission for permission to construct a road, to be operated by electricity, four and one half miles long, to run from Buffalo to Gardenville and Ebenezer.

WASHINGTON, PA.—The Council has granted permission to the Washington Electric Street Railway Company to put up poles and string a feed wire along East Strawberry Alley, from the power house to Main Street. The work will be done under supervision of the borough engineer.

MAYS LANDING, N J.—The Camden & Atlantic Railway Company has decided to double-track the entire road, which runs from Camden to Atlantic City, a distance of 60 miles. Work will be begun at once. The question of equipping the road with electricity was discussed, but was not finally decided.

POUGHKEEPSIE, N. Y.—It is reported that the Poughkeepsie Transportation Company is to build the New Paltz & Highland road, a charter for which was obtained some time ago by B. Van Steenburgh, of 53 Broadway, New York City, and Goshen, N. Y.

RICHFIELD SPRINGS, N. Y.—At the meeting called by the trustees of the village, Aug. 23. for the purpose of obtaining the opinion of the property owners regarding the granting of a right to permit the building and operating of an electric road through several streets, the general voice was against the project.

HARRISBURG, PA.—The North Susquehanna Transit Company, which was incorporated on Aug. 1, has been granted franchises in Danville, Bloomsburg, Catawissa, Rupert and Riverside, and the work on the construction of the road will soon be commenced. E. S. Whitney, of Allentown, is president of the road.

WHEELING, W. VA.—The Second Avenue Traction Company, of Pittsburg, is negotiating for the purchase of the Wheeling Railway, also the Belair & Martins Ferry Road across the river, and it is understood that the Traction Company will build lines connecting the Wheeling roads with Pittsburg lines at Carnegie, Pa.

VALLEY FALLS, R. I.—The Cumberland Town Council has given permission to the Woonsocket Street Railway Company to build and operate an electric railway, from the Woonsocket line. on the Woonsocket & Cumberland Hill road, via Cumberland Hill, to the Lincoln town line at Manville Bridge. The president of the company is E. K. Ray.

ST. LOUIS, MO.—George W. Baumhoff, contractor for the construction of the St. Louis & Kirkwood Electric Railway, is pushing the work fast. Nearly two thirds of the grading is completed, and over half of the rails are distributed along the route, while the power house is nearly finished. The road will be opened for traffic on Thanksgiving Day.

WASHINGTON, D. C.—At a recent meeting of the Columbia Heights Citizen's Association, John R. Gisburne, appointed to confer with the postal authorities relative to the establishment of a street railway system, reported that he had addressed letters to Postmaster Willett, and had been assured that everything possible would be done to establish this system.

HARRISBURG, PA.—The Harrisburg & Mechanicsburg Railway Company has been reorganized, with Hon. B. F. Myers as president. The company has succeeded in having the injunction which restrained it from crossing a highway bridge, near West Fairview, Cumberland County, dissolved by Judge Biddle. This will give the line an entrance to West Fairview.

EDGEWATER, S. I., N. Y.—At the meeting of the Edgewater trustees on Tuesday the Midland Electric Railway Company made an application for a franchise upon the Richmond road and Van Duzen Street. President Johnstone doubted whether it could be granted, as the Interior Company had already been given a right of way over those streets. The matter was referred to counsel.

HAMILTON, ONT.—The Hamilton Radial Electric Railway Company has applied for right of way along Cannon Street. It is understood that the company has abandoned for the present, at least, all idea of extending the Niagara Central, the present intention being to construct a double-track trolley road between Hamilton and Niagara Falls. Ninety-pound rails are to be used in the track construction.

DANVERS, MASS.—The Danvers Selectmen have been informed that the Lynn & Boston Street Railway Company will reduce the fares between Salem and Danvers (either station) to five cents. The company declined to make the fares five cents on the Putnamville, Asylum and Centre branches. The five-cent fares from Danvers Village allow passengers to ride to Marblehead or Beverly line, a distance of more than six miles.

BROOKLYN, N. Y.—Postmaster Sullivan, of Brooklyn, is negotiating with the Brooklyn Heights Railway Company for the introduction of postal trolley cars on the Fulton Street line, and they will be introduced just as soon as he receives the approval of the Washington authorities. He also proposes before long to introduce postal cars on the cross-town line, and thus facilitate the transfer of the mails to and from Long Island City.

BROOKLYN, N. Y.—The Brooklyn Heights Railway Company has completed its improvements at its station at the bridge entrance, and a car of each of its lines will be constantly at the stand hereafter for the convenience of passengers. A staircase has been erected to make access to the bridge easier, and shelter also has been placed over the approach. The terminal will be brilliantly illuminated with electric lights at night.

SYRACUSE, N. Y.—The Council has passed over the mayor's veto the resolution giving a franchise to the Syracuse & Oneida Lake Electric Railway Company. The company agrees to pay into the city treasury on Jan. 1 of each year 1 mill for each passenger carried during the preceding 12 months. If the money is not paid, the city may recover it by an action at law, or declare the franchise forfeited at the option of the city authorities.

BROOKLYN, N. Y.—The Nassau Electric Railway has just received a shipment of 14 carloads of steel rails for its branch line to Manhattan Beach. Five hundred men will be put to work at once laying the track, starting at Ocean Avenue. More men will be put on in proportion with the quantity of rails received. It is expected that the new branch will be ready by Oct. 1, and then patrons of the road may go to Manhattan Beach for five cents.

CHICAGO, ILL.—The Chicago City Railway is completing the renewal of tracks on its Indiana Avenue line from Thirty-ninth Street south to Fifty-first Street. The old rails have been replaced by rails used in electric service, it being the intention of the company to equip the road with the trolley system. At the main offices it is said that the work of stringing wires might not be commenced this year, nor had it been settled whether the line would be extended beyond its present southern terminus.

PITTSBURG, PA.—Christopher L. Magee is the moving spirit in a project to consolidate the street railways in this city which, if accomplished, will involve 200 miles of lines and $25,000,000 of capital. The Widener-Elkins syndicate is said to be behind him. The roads that are included in the proposed plan are the Pittsburg, Allegheny & Manchester Traction, Pittsburg Traction, Duquesne, Citizens' Traction, Federal Street & Pleasant Valley Passenger Railway, Pittsburg & Birmingham Traction, Central Traction and the Second Avenue Passenger Railway Company.

ANNUAL ELECTION IN BUFFALO.—At a recent meeting of the stockholders of the Buffalo, Kenmore & Tonawanda Electric Railway Company the following directors were elected: Nicholas Kelley, Martin McDonough, Patrick M. Culliny, Frederick B. Eberhardt, Thomas L. Day, James W. McDonald, Frances E. A. Zimmerman, James J. Byrne, John L. Donovan, Louis P. A. Eberhardt, Frank S. Oaks, Alexander Martin, Jeremiah F. Sheehan, Daniel F. Callahan and George H. Frost. Officers: Daniel F. Callahan, president; Frank S. Oaks, vice-president; Fred W. Plato, secretary and treasurer.

AUBURN, N. Y.—The City Council has granted a franchise to the Auburn City Railway Company to extend, maintain and operate its lines through the Second Ward to the lake on the west side. In addition to the $6,000 bond that they would in good faith live up to the agreements in the franchise, an additional bond of $5,000 was required to be furnished that the line be finished inside of a year. Gorton W. Allen, representing the company, stated that if it received proper encouragement it would build into all the surrounding towns, such as Weedsport, Geneva and Waterloo, and on the other side extend its tracks to Syracuse.

TRADE NOTES.

THE BERLIN IRON BRIDGE COMPANY, East Berlin, Conn., has secured the contract for the new car barn of the Hartford Street Railway Company. The office will be located in the front end of the building on State Street, with the barn proper in the rear. The whole construction is to be of steel and fireproof, the roof being covered with the Berlin Iron Bridge Company's patent anti-condensation corrugated iron roof covering.

THE HOLLY STEAM ENGINEERING COMPANY, of Providence, R. I., has recently booked the following contracts for installations of the Holly gravity return system: Portland (Me.) Street Railway Company's power station; Holyoke (Mass.) Street Railway Company's power station; Builders' Iron Foundry, Providence. R. I.; Corliss Steam Engine Company, Providence; Brown & Sharpe Manufacturing Company, Providence (second installation); The Phelps Publishing Company, Springfield, Mass.; Twenty-fifth Street power station; Metropolitan Traction Company, New York City, and Fall River Bleachery, Fall River, Mass.

AN ATTRACTIVE NEW CATALOGUE has just been published by J. E. Lonergan & Co., 211 Race Street, Philadelphia, manufacturers of high-grade engine and boiler trimmings. The catalogue includes oilcups, crank-pin oilers, sight-feed lubricators, water gauges, combination water columns, gauge cocks, indicator cocks—in short, a complete line of engine and boiler brass trimmings. Besides the goods of its own manufacture, the firm handles some fine specialties of other makers. The catalogue is of a very handy size and shape, and is nicely bound in cloth, forming an unusually good reference book.

IN AN ATTRACTIVE CIRCULAR issued by the Mason Electric Company, 307 Dearborn Street, Chicago, and describing the celebrated Medbery insulating material for which the company is the Chicago agent, attention is called to the fact that Mr. W. R. Mason, general manager, has had five years' practical experience in electric railway supplies exclusively, thoroughly understands the requirements of electric roads, and believes that he is in a position to handle their orders intelligently and satisfactorily.

HOEFGEN, MOXHAM & CO., contractors and general supply agents, 80 William Street, New York, who are New York agents for the well-known "Medbery" railway material, report orders for over $100,000 worth of these goods since they started in business a few weeks ago. In a nicely executed and handy catalogue just issued, the firm states that it is in position to furnish any and every article needed by street railways, and special reference is made to line material, poles, snow plows, the new "Bonta" emergency brake, power-house equipment, cars, motors, headlights, registers, Okonite wires and cables and Manson tape. Specially large orders are reported as received from the following roads: Allentown & Lehigh Valley Traction Company, Allentown, Pa.; Nassau Electric Company, Brooklyn; Yonkers Railway Company, Yonkers, N. Y.; Fort Wayne Electric Railway Company, Fort Wayne, Ind., and Citizens' Railway Company, Detroit, Mich. Messrs. Hoefgen, Moxham & Co. claim to handle only the best goods and assure intending purchasers of prompt, courteous and honorable treatment.

Record of Electric Railway Patents.

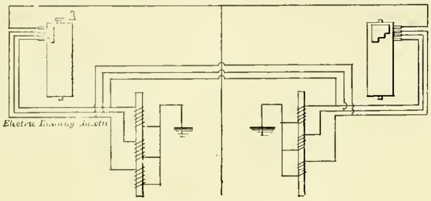
UNITED STATES PATENTS ISSUED SEPT. 3, 1895.

545,498. ELECTRIC BRAKE; William L. Hedenberg, New York, N. Y. Filed May 7, 1894. A bar is pivotally carried by the truck and wheels and provided with polar extensions. It has its ends in proximity to the wheels. Shoes are operated by the bar, springs hold the bar away from the wheels and stop pieces act with the springs. A plurality of coils on the bar magnetizes it, and cause it to approach the wheels. A controller is arranged to energize the coils of like relation to the polar extensions (See Illustration.)

545,520. TROLLEY GUARD; James T. Moody, William Shawd and Adam J. Baker, Springfield, O. Filed Feb. 23, 1895. The trolley head comprises similar side pieces having a socket at one end to receive the trolley pole, and having guideways at the opposite end. Means are provided for securing the side pieces together and clamping the trolley pole between them.

Lateral guards are adjustably held in the guideways and a shaft is journaled to one of the lateral guards and has a crank arm to which the releasing rope is attached. A latch guard is attached to the shaft and has its free end entering a notch in the remote lateral guard. A spring normally projects the latch guard across the space between the lateral guards.

545,579. CAR FENDER; Robert Bustin, Boston, Mass., assignor of two thirds to Wesley Vanwart, Fredericton, and John R. McConnell, Marysville, Canada. Filed Dec. 5, 1894. A bar or beam is pivoted to the car-truck and extends forward therefrom. An axle or shaft is journaled in the front end of the bar or beam and has guide-wheels for traversing the railway rails. A yoke-shaped frame is provided with journal boxes in which the axle or shaft is journaled, and has its front end portions extended laterally over the railway rails. Uprights or standards are carried by the lateral extensions of the yoke-shaped frame and stretcher-bars connected with the lower ends of the standards or uprights. A rod or shaft connects the front ends of the stretcher-bars and is provided with an elastic buffer. A net is connected with the rod or shaft and with the upper ends of the standards or uprights.



No. 545,498.—ELECTRIC BRAKE.

545,585. CAR SIGNALING APPARATUS; Charles Harold, New York, N. Y. Filed Dec. 10, 1894. Two alarms are located at the ends of the car and two actuating devices project adjacent to each other from each platform of the car. There is an operative connection from one of the devices to the alarm at the same end of the car, and an operative connection from the other actuating device to the alarm at the opposite end of the car.

545,627. FARE REGISTER; Henry F. Hughes, Brooklyn, assignor to W. Kennon Jewett, New York, N. Y. Filed Sept. 27, 1894. An actuating lever, a locking lever with a finger piece and adapted to be moved in and out, and to remain in either position it is placed in. An engaging device is connected with the actuating lever, and an engaging device is in engagement with the locking lever and is adapted to be by it moved into engagement with the engaging device connected with the actuating lever.

545,649. TROLLEY ARRESTER; Henry F. Hildebrandt, Rochester, N. Y., assignor of one half to Martin C. Rutherford, same place. Filed May 6, 1895. The trolley arrester has a case the top of which is provided with an opening. A portion of the opening is contracted, and there is a spring within the case. A cord is secured to the upper end of the spring, the upper end of which is adapted to be secured to the trolley arm, and a button upon the cord is adapted to rest upon the top of the case above the contracted portion of the opening.

545,664. METHOD OF AND APPARATUS FOR CONTROLLING CURRENT FOR ELECTRIC MOTORS; Thorsten von Zweigbergk, Cleveland, assignor of one half to George C. Worthington, Elyria, O. Filed Nov. 1, 1894. The process of reducing the current for electric motors on street cars consists in connecting in some part of the circuit then existing an arc-spanning system which includes a plurality of separable contacts in series, then connecting up the reduced circuit in parallel with that part of the first circuit which contains the arc-spanning system, and then, after both of the above-named steps have been performed in either order, simultaneously separating a plurality of the separable contacts. (See Illustration.)

545,686. TROLLEY; Zachry T. Furbish, Augusta, Me. Filed July 12, 1895. The trolley comprises the forked rod, the depending arms, sockets formed in the end thereof, the two-part shaft having the spherical or bulbous heads fitting the sockets, and the wheel journaled in the shaft and having a hub for confining the free end of the shaft.

545,704. SAFETY FENDER FOR STREET CARS; Jay B. Lyford, Bridgeport, Conn., assignor to the Lyford Car Fender Company, Boston, Mass. Filed Aug. 29, 1894. Renewed July 20, 1895. An open rectangular frame has a vertical portion adapted to be secured to the dashboard of a street car and has a horizontally extending lower portion connected to the upper portion by coil springs. The brace rods are pivoted at opposite sides of the frame to the upper and lower portions respectively, and are hinged together at their inner ends. A safety net is carried by the frame, substantially as set forth.

45,717. ILLUMINATED SIGN FOR STREET CARS; Henry Pearson and Elizabeth A. Rice, Springfield, Mass. Filed Dec. 12, 1894. A hollow rotatable sign has openings through its ends, and has a support at and for each end, consisting of a standard having its upper portion constructed in the form of a shell with a socket or mouth for the engagement therewith. The circular end portions of the sign are rotatably journaled therein. Each of the shells is formed in two separable sections hinged together, and a lamp is located in each of the shells opposite the end openings of the sign, whereby the shells may be thrown open to afford access to the lamps and to permit the removal and replacement of the sign.

545,771. SAFETY ATTACHMENT OR FENDER FOR CABLE, ELECTRIC, OR OTHER CARS; Robert Bustin, Boston, Mass., assignor of two thirds to Wesley Vanwart, Fredericton, and John R. McConnell, Marysville, Canada. Filed Feb. 9, 1895. A fender carry-truck is arranged beneath the car platform, and hangers are rigidly mounted on the under side of the platform. Housings are mounted on the frame of the fender truck and have chambers entered by the hangers. Springs are arranged in the chambers and exert their tensions upon the hangers. The fender frame is wholly supported by the fender truck.

545,798. RAIL STRUCTURE; Frank P. Howe, Philadelphia, Pa., assignor to the William Wharton, Jr., & Company, incorporated, same place. Filed Aug. 29, 1894. The rails have undercut recesses at their intersecting points, and are secured together by cast metal having formed therein cavities which are continuations of the recesses in the rails, with a metal plate cast into the recess at the intersecting point of the rails. The plate filling the cavities is formed in the rail and the securing casing, and acts as a riser or wear plate as well as additional means for securing the rails together.

545,802. FARE REGISTER; John J. Kennelly, New York, N. Y., assignor of one half to John B. Benton, same place. Filed Nov. 28, 1894. The registering apparatus has two registering devices enclosed in a casing furnished with sight-apertures to disclose the numerals on the respective register wheels. An operating pull is provided common to both registering devices, a shifting mechanism is adapted to connect the pull with either registering mechanism, at will. There is a movable screen for the sight-apertures, the screen being connected to the shifting mechanism and adapted to be operated thereby, so that when a registering mechanism is disconnected from the pull, its sight-aperture will be closed by the screen.

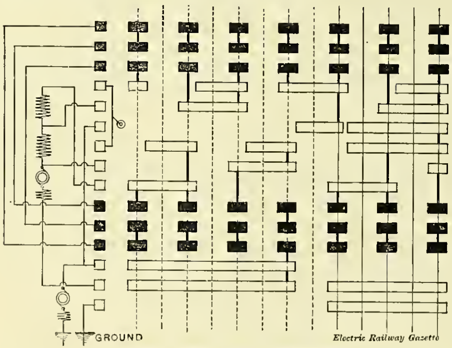
545,806. TROLLEY WIRE SUPPORT; John W. Meaker, Evanston, Ill. Filed Nov. 17, 1894. This is the combination with a hanger, of a clip adapted to be attached thereto for the purpose of gripping the trolley wire; the clip is movable longitudinally of the hanger in one direction or the other for the purpose of tightening or loosening the trolley wire. Means are provided for locking the clip to the hanger when shifted thereupon to tighten the wire against the hanger.

545,810. CAR BRAKE; Frank P. Musser, Beaver Falls, Pa. Filed April 22, 1895. This combines the following in a brake mechanism: the brake-bar and the clog or segment having a recess in the outer side of the rack arm, the shoe pivoted to the lower end thereof, the friction spring, the transverse shaft, the pinions at the ends thereof, the central rack pinion, the lever journaled on the shaft and connected with a vertical operating lever, the double or reversible spring-actuated pawl, the bell cranks, the pivoted handle and connections.

545,820. RAILWAY SWITCH; Edward Samuel and Victor Angerer, Philadelphia, Pa. assignors to William Wharton, Jr., & Company, incorporated, same place. Filed April 18, 1894. The switch tongue has a pin, the opening in the switch structure being larger than the pin, with metal cast in the opening and around the tongue. The cast metal is locked to the switch structure so that the pin will turn within the cast metal bushing.

545,821. TRACK STRUCTURE; Edward Samuel, Philadelphia, Pa., assignor to William Wharton, Jr., & Company, incorporated, same place. Filed Nov. 3, 1894. The frog or other rail structure is composed of two or more rails permanently secured together by a cast metal section forming a recess at the centre or crossing point, with a hard metal plate secured to the cast metal section of the structure, the upper face of the plate forming a continuation of the rail sections.

545,833. BOND FOR ELECTRIC RAILWAYS; Alonzo S. Wheeler, Saugatuck, Conn., assignor of one half to Clarence L. Wheeler, Marion, Ind. Filed Jan. 14, 1895. The bond for electric railways is provided with upwardly extending projections taking into holes formed in the rail ends which are thus made electrically continuous. The chair joint consists of a chair provided with a flange which is recessed to receive the bond which is located between the flange and the rail ends. The said chair joint also consists of a drawbar adapted to be inserted into the chair and engages with the opposite faces of the webs of the rail ends.



No. 545-664.—CONTROLLER.

545,849. CAR BRAKE; James H. Core, Etna, Pa. Filed April 29, 1895. Brake shoes are adapted for engagement with the inner peripheral surfaces of the wheels and for engagement with the track. The shoes are provided with link shanks and guides passing through the shanks. The shafts are located between the link shanks of the brake shoes. Segments are secured to the shafts and lifting chains are attached to the shoes and to the segments extending over their cylindrical surfaces. Levers are attached to the shafts carrying the segments and extending both above and below the shafts. A crossed link connection is made between opposing levers, rock shafts being adapted to be journaled at the ends of the car, terminating in crank arms. There are link connections between the crank arms and the lower ends of the levers.

Electric Railway Gazette.

Vol. XIII. NEW YORK, SEPTEMBER 21, 1895. No 12.

Montreal Street Railways—II.

Mount Royal Incline Railway.

ONE of the most interesting trips in Montreal is that to the summit of Mount Royal, from which the city derives its name. The mountain rises to a height of 759 feet above low water in the harbor and is reached by the Mount Royal Incline Railway. The station at the lower terminus is reached by the cars both of the Montreal Street Railway and those of the Montreal Park & Island Railway. The total length of the incline is 1,520 feet, which is constructed in two sections. The first is 1,100 feet long, with a grade of one foot in 12. Two cars are operated on this section which are similar in appearance to the ordinary street railway box car. The power plant for operating this section is located at the head of the first incline and consists of two 25-hp McDougall engines and White boilers manufactured in Montreal; two one-inch steel ropes are employed. Two winding drums are mounted on the same shaft, and the ropes are so arranged that while one car ascends the incline the other descends.

The second section has a horizontal projection of 520 feet and an elevation of 250 feet. The cars are in the form of a series of steps or platforms upon each of which are two cross seats. The sides of the cars are entirely open, but protected by a railing and wire netting. A magnificent view of the surrounding country may be obtained as the car ascends the incline. Two cars are operated by three independent ropes. Two one-inch ropes are employed pulling each car and in addition there is a safety rope 1⅛ inches in diameter.

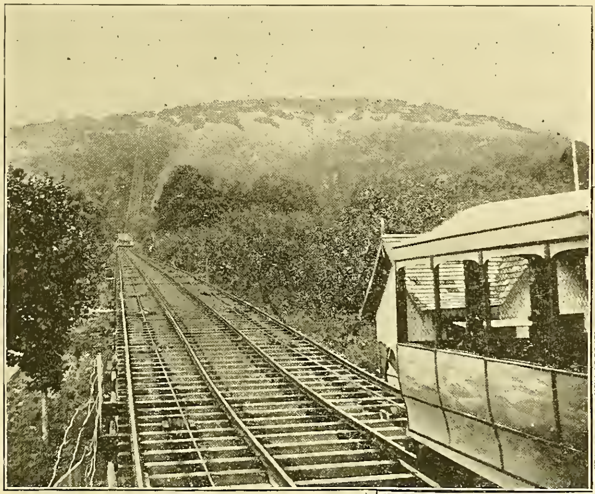
The safety rope is attached to the car between the two hauling ropes and extends to the top of the incline where it runs round a sheave and is attached to the second car. This rope is not connected to the winding machinery and is simply employed as a safeguard.

The power plant is located at the summit of the mountain, and consists of two 150-hp engines, built by George Bush, of Montreal, who also furnished the boilers.

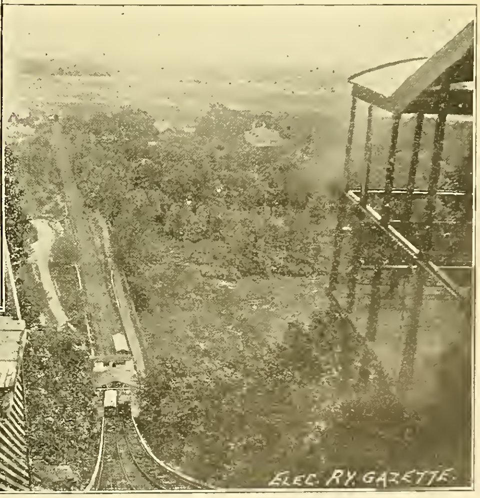
T-rails are employed, and are spiked to ties extending the full width of the two tracks.

The cars are run every five minutes and 8 cents is the fare for the round trip. The view from the summit in every direction is magnificent, and will amply repay the tourist for the time required to make the trip. On one side a bird's-eye view of the city, with its numerous churches and cathedrals and massive public buildings, is presented, stretching out for a distance of five miles.

Away to the right is seen the Victoria Bridge, which connects the Grand Trunk Railway with the Island of Montreal and the south shore of the St. Lawrence. The bridge is two miles in length, was built at a cost of $6,300,000, and was considered one of the most remarkable engineering feats of the time. The bridge is built of iron, on the tubular principle, and the tube through which the trains pass is 22 feet high and 16 feet wide. There is



MT. ROYAL RAILWAY—VIEW FROM FOOT OF INCLINE.



MT. ROYAL RAILWAY—VIEW FROM SUMMIT SHOWING BOTH INCLINES.

a long abutment at each end and 24 piers of solid masonry. The piers were built very massive to withstand the strain of ice flows which occur in the spring.

MONTREAL PARK & ISLAND RAILWAY.

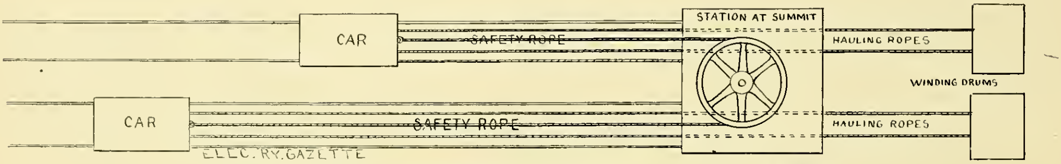
The Montreal Park & Island Railway Company operates about 20 miles of road, mainly of single track, with turnouts. The road extends through some of the most attractive suburbs of Montreal, and a trip over the line affords to the passenger a succession of pretty views, many of which are of great historical interest.

The system consists of two main routes, one running through St. Lawrence Street to Back River, and the other extending along Bleury Street and Park Avenue, passing through Montreal Annex and Outremont to Côte-des-Neiges.

The road is now being extended from the latter place round the western spur of Mt. Royal, where connections will be made with the system of the Montreal Street Railway Company, the Park & Island Company having the privilege of operating its cars over the former company's tracks in the city.

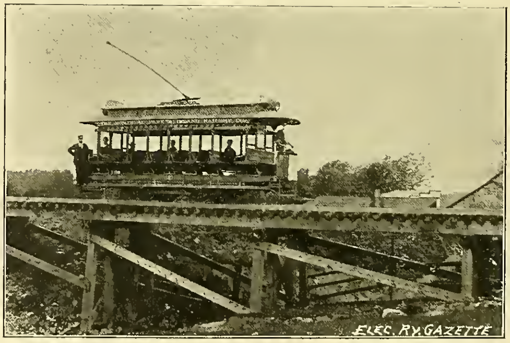
The Côte-des-Neiges line leaves the city at an historical spot, known as Fletcher's Field, and extending up the slope of the lower spur of Mt. Royal passes over the ground where numerous reviews of the Canadian militia have been held. From this point a beautiful view of the boldest front of Mt. Royal may be obtained. The line passes the spacious exhibition grounds, where are annually held the Montreal industrial exhibitions; thence through Montreal Annex, a populous suburb, and along the Outremont road and around the northern side of the mountain. The opening of the electric railway has brought this district into direct communication with the heart of the city, and as a result the neighborhood is rapidly building up with handsome suburban residences. A branch line of the railway extends to the entrance of Côte-des-Neiges Cemetery, a particularly historical and picturesque spot. The Back River line emerges into the open country at the Canadian Pacific Railway crossing at Mile End and follows a somewhat crooked course to Sault-au-Récollet, or Back River. The route first extends through the open country to the grounds of the Shamrock Lacrosse Club, thence through the northern limits of St. Denis Boulevard and Amherst Park to Back River Park. From this point the line extends about a mile along the river bank through the typical French-Canadian village of Sault-au-Récollet to the end of the road where a neat terminal station has been built by the company.

VIEW FROM SUMMIT OF MT. ROYAL.



MT. ROYAL RAILWAY—ARRANGEMENT OF SAFETY AND HAULING ROPES.

MONTREAL PARK & ISLAND RAILWAY—PRESENT TERMINAL STATION OF SAULT-AU-RECOLLET LINE.



MONTREAL PARK & ISLAND RAILWAY—TRESTLE ON SAULT-AU-RECOLLET LINE.

The company's power station is located in the Provincial Exhibition Grounds, on Mt. Royal Avenue. Royal Electric and Westinghouse systems are employed. The company operates handsome open and closed cars of Canadian manufacture, equipped with Royal Electric and Westinghouse motors. The closed cars are handsomely furnished and decorated, and ample provision has been made for heating during the extreme cold of the Winter. The open cars are provided with four stationary and five reversible seats, giving a total seating capacity of 45 passengers.

MONTREAL PARK & ISLAND RAILWAY—NEAR BACK RIVER PARK.

The track construction throughout the road is of a very substantial character. Fifty-six-pound T-rails are employed on all of the suburban lines. They are spiked to Tamarack ties and the tracks are ballasted with broken stone throughout. The rails are bonded with heavy copper wire and are cross-bonded at every sixth joint.

MONTREAL PARK & ISLAND RAILWAY—STATION AT BACK RIVER PARK

Wooden side poles are employed and the overhead material is of the best.

The lines of the road will be extended and new equipment will be installed, eventually forming one of the most complete electric railway systems in Canada.

Practical Notes for Motormen—XV.

BY GEORGE T. HANCHETT.

Three-Wire System.

If we have a number of electrical devices, each requiring a certain current, and connect them in multiple with a source of supply, it is obvious that we must supply a line of sufficient carrying capacity and suitable resistance to deliver a current sufficient to operate all of these various devices, which current is the sum of the currents of all the devices. If we limit ourselves to a certain loss of pressure, we thereby fix the resistance, and, therefore, the size of the conductors which carry the current. Copper wire is very expensive, and while it is desirable to have a small loss of pressure, it is also desirable to have as small a wire as possible ; these two conditions are incompatible. We may transmit the required horse-power by reducing the current and using a higher voltage.

If we allow E to represent the drop, C the current, and R the resistance of the wire, then $E = CR$, and if we fix the value of E to, say, 50 volts, it is obvious that if we desire a small wire of large resistance we must, in order to meet the conditions we have imposed, reduce C.

It is not desirable in street railway work to reduce the current and keep up the horse-power by increasing the voltage, for the reason that a railway motor, designed for a voltage higher than 500, would be costly, more likely to get out of order, and, under the present system of trolley construction, would be very dangerous. It is not desirable to have the potential difference between the trolley system and the ground more than 500 volts. If, however, we can have a source of potential at the station delivering current to one trolley wire, from which it passes via a car to the ground, and via another car up to a second trolley wire, and thence returning to the station, the current required will be that necessary for one car, but the voltage must be sufficient to force that current through two cars, and therefore double what it is in ordinary practice. It is to be noted that the potential difference between the ground and trolley is but one half the total voltage used (see Fig. 47). Such a system as this would of course be open to serious objection. The two cars being in series would interfere with each other; when one stops by breaking the circuit the other must stop also. Further than that, if, as is very likely, there are a greater number of cars upon trolley wire A than upon trolley wire B, the voltage on the two sets of cars would be unevenly divided.

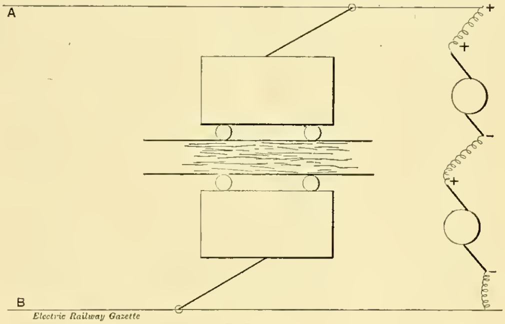


FIG 47.

Suppose, for example, that there are two cars on one side of the line and one car on the other. The motormen of all three cars, we will say, desire full speed; the third car must take the sum of the currents of the other two, and the fall of the potential around it will be considerably greater. As a result of this unequal division car number three will proceed very rapidly indeed, while cars one and two will be correspondingly slow. Where a large number of cars are operating the difficulty might be so far aggravated as to produce a dead standstill on one side of the line, while the cars on the other side proceeded at nearly double their normal speed. Aside from this it is doubtful if the motors would stand such hard usage.

The difficulty of unequal distribution of voltage has been successfully met by the Edison three-wire system, and has reduced the impracticable system, just described, to a thoroughly practical one, presenting many points of vantage. It is shown in Fig. 48.

Two dynamos of the required voltage are connected in series, thus producing the necessary voltage at their two free terminals, *A* and *B*. The cars, or other translating devices, are connected in precisely the same way as before, with the important exception that a third wire, called the neutral wire, connects the middle of the two translating devices to the wire connecting the two generators. This effects a perfect balance of voltage between the two systems.

Wherever there are more devices on one side of the system than on the other, the dynamo on the side having the more devices is more heavily loaded. Although it is an advantage to have both dynamos equally loaded, by properly wiring up a system it is possible to reduce this unbalancing to a negligible amount.

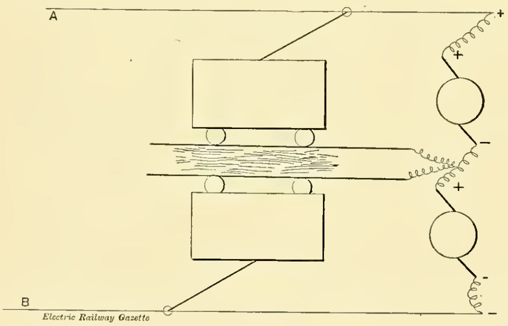


FIG. 48.

In a railway system the application would be as follows: There would be two distinct sets of feeders, one for each side of the three-wire system. The area of these feeders would be of sufficient capacity to carry just one half of the current the cars require. The neutral or third wire would be the ground. As a usual thing the current will pass out of one feeder down the trolleys of one set of cars and into the ground; whence it would pass into the wheels of the other set of cars, up to their trolleys and into the second set of feeders, back to the station. If there should be on the positive side of the system more cars than on the negative side, these cars would return their current to the station via the neutral wire, or, in this case, the ground. If there be more cars on the negative side, the extra cars will receive their current from the neutral wire, and not from the positive feeder. Therefore the current in the neutral wire is fluctuating, sometimes in one direction, and sometimes in the other.

In order to successfully maintain a three-wire system, it will be at once noted that a totally different method of bonding the rails is necessary. Particular care must be taken to connect the tracks of one system of cars to those of the other, while the bonding of the rails making a continuous run to the station need not be so powerful. The necessity of securely connecting the tracks of the positive and negative cars together makes it obvious that it would not be economical to employ three-wire methods on any but a double-track system.

If the two tracks were used as either side of the three-wire system, their proximity to each other would enable them to be readily bonded together.

The advantages of a three-wire system are not so great in railway work as in lighting, although at first sight they are more so. The object of the three-wire system is to save copper by reducing the current to be carried. The expense of bonding the rails is, in each case, about the same.

To compare the amounts of copper that the two systems require, assuming that equal amounts of energy are lost in the transmission, we must consider a case where the loss in the return circuit is a certain definite amount. Say, is equal to the loss in the feeder circuit.

In the three-wire transmission, one half the current is transmitted as double the voltage. Hence, for equal losses of energy, the loss of pressure must be twice as much in the three-wire system as in the two wire. Assuming a definite case of two-wire transmission, where the loss in the line is 25 volts, and in the return 25 more, a parallel case in the three-wire system would lose 50 volts in each feeder. Confining ourselves to a definite case, let us suppose that we are to deliver 200 amperes to the cars at a loss of 50 volts. In the two-wire system one half of it is lost in the return, and the other half in the feeder. The resistance, therefore, of the lines is $\frac{25}{100}$ or one eighth of an ohm. On the three-wire system we transmit but 100 amperes, and lose 50 volts each way. The resistance of one distance of the three-wire system is one-half an ohm, but as we have to return the current to the station, via a pole line, and are not permitted to use the ground, the total amount of copper is equal to two such lines, and the relative weights are as 1 is to 2 in favor of the three-wire system.

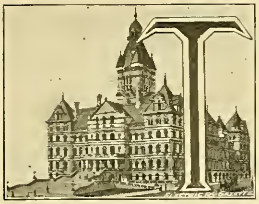
In the three-wire system, because the heavy currents that flow in the ground flow through relatively short distances, and because the light current returning to the station is sometimes in one direction and sometimes in the other, it must necessarily follow that trouble from electrolysis of pipes will be very much reduced.

(*To be continued.*)

Union Traction Company of Philadelphia.

The directors of the Union Traction Company of Philadelphia, into which the Philadelphia Traction Company, the People's Traction Company, and the Electric Traction Company, of that city, are to be practically merged, met on Tuesday last for the election of officers. The present officers of the People's Company were elected to fill similar positions in the new company as follows: President, John Lowber Welsh; secretary and treasurer, Charles O. Kruger, and manager, J. R. Beetem. The new company was organized with a capital stock of $100,000, and the amount was increased to $30,000,000.

NEW YORK STATE STREET RAILWAY CONVENTION.



THE New York State Street Railway Association held the most successful meeting in its history, in Albany, on Tuesday last. To the president, G. Tracy Rogers, not a little credit is due for arranging an admirable programme and in stimulating interest in the convention ; indeed, it was found that the time was much too limited for following out the plans arranged for the business session. The topics prepared for discussion were of great practical importance to street railway men, and had time not been lacking, there would have been no failure in the general discussion. The attendance was not as large as had been anticipated, as circumstances combined to detain a number of members who had confidently expected to be present.

The meetings were held in the assembly room of the Young Men's Christian Association Building, which adjoins the Kenmore Hotel, the headquarters of the Association. This year it was decided to make provision for those who wished to make exhibits, and a room adjoining that in which the business sessions were held was set apart for the purpose. It will be seen from the mention of exhibits made elsewhere in this report that quite a number of manufacturers availed themselves of the opportunity to show samples of their apparatus and supplies. After the meeting had been called to order on Tuesday morning the president, G. Tracy Rogers, of Binghamton, made the following address:

President's Address.

"In the name of the Street Railway Association of the State of New York I extend to each and every one of you a hearty welcome. Many of us have met before in this, the capital of our State, and the third oldest city of our Union, but under different circumstances than surround us to-day. We miss from our number one familiar face. An all-wise power has seen fit to remove from our midst our late respected secretary and treasurer, Mr. William J. Richardson. Mr. Richardson's connection with the street railway business dates from 1876. He was our secretary and treasurer for a number of years. The excellent results attained by this organization are largely due to his executive ability and the interest and enthusiasm which he manifested in conducting the affairs of the Association.

"It is a matter of congratulation to us that the affairs of the Association are in a healthy and prosperous condition. Many new roads have joined during the past year and we have reason to believe that others will follow their example during the ensuing year. The year that has passed since our last annual convention has been one of no unusual events in the street railway world. There have been no radical changes or startling developments in electric railway machinery or appliances, but from a general review we note the steady advance of the past year and the many opportunities for the future which present themselves for our careful consideration.

"We have been treated fairly by the Legislature of our State. The men elected to make our laws have been, as a rule, desirous of subserving their constituents, and their anxiety to do so has, in some instances, made them over-zealous. Many bills were introduced last year, some of them, we hope, with the best of intentions; but had they become laws, the general public, as well as ourselves, would have suffered. The committees, however, were composed of men of ability and good judgment, and they have been ready to listen to our arguments and to legislate for the greatest good of the greatest number.

"The result of the year's experience shows a demand for better roadbeds and overhead construction, heavier rails, more ties, better ballasting, lighter motors, better machines, and more conservative financiering.

"A great deal has been said and written regarding the substitution of electricity for steam for through traffic, and some of these articles have been severely criticised. The fact that electric traction is being considered by steam railway people makes it a subject of general interest. They may adopt electricity on some of their suburban lines to protect their local travel, which we have taken from them, whenever and wherever we have gone after it, but the results cannot materially affect the interests of street railways. We carry our patrons to their doorsteps, the public streets are our depots, we have no expensive stations to maintain, our traffic is more certain, less affected by business depressions, and more capable of development than that of the steam railway. These are advantages that the steam railways are unable to overcome, and, together with the paralleling of steam railways by electric railways, have forced a number of railway companies into purchasing electric lines, and there is evidence of increased activity in that direction. The adoption of an electric motor, in Chicago, to propel a cable road, the Westinghouse-Baldwin combine, the 90-ton freight engine on the Baltimore & Ohio road, the building of the electric railway at Nantasket Beach, by the N. Y., N. H. & H. Ry. Company, as a part of their system over which electric cars and locomotives are run intermingled, and the electrical construction of the Mount Holly branch of the Pennsylvania Railway, all point to an endorsement of electricity as a motive power.

"An experiment is now in progress in New York with power from conductors from an underground conduit, the results of which will be watched with great interest, as it may be the beginning of a new régime in street railway work in large cities. The results, however, can have no effect in smaller cities on account of the cost.

"We now have in this State about 1,400 miles of track and an investment of upward of $200,000,000. We carry, every year, seven times the population of the entire United States, and over one third the population of the entire world—over 500,000,000 passengers annually—while the steam roads carry but 160,000,000. The gross receipts of this street railway traffic are about $25,000,000. The best and most reliable financial papers now seek and publish such statistics as are attainable regarding street railways. The financial world demands this information and we are compelled to furnish the figures, favorable or unfavorable. Street railway securities, as permanent investments, are in better favor than ever before.

"The consolidation for the purpose of controlling all the street railways in any one city, and the rapid extension of cable and electric lines, both urban and suburban, has attracted the attention of financiers and investors, and large sums of money have been invested both by local and foreign capitalists. And here I would suggest the importance and wisdom on the part of any road of placing its securities with the local investor, if possible, for reasons too obvious to mention.

"The cost incident upon the change from animal power to cable or electric was staggering to the investor. The large electric companies came to the rescue in many instances after gathering statistics of operations and increased receipts caused by the adoption of rapid transit, and ascertaining the ability to earn more than enough to pay the interest on the cost of the change. Such information unfortunately invited speculating capitalists, who, in many instances, took advantage of the additional profit. Over-capitalization, which has been prevalent in years past, is gradually disappearing by reason of foreclosure of mortgages and a general desire for conservatism on the part of financial people interested. In a growing city, with a sound franchise, reasonable capitalization, and a well-installed system, for which too much has not been paid, the securities should and do commend themselves to the conservative investor.

"The fields which are rapidly opening and which invite our attention are numerous, and I shall call your attention to but a few. The United States Government is asking us to carry its mail; society has popularized us with her trolley parties; the express companies are negotiating with us to handle their freight; the merchants wish us to carry their goods, the farmer his milk and farm produce; and we are asked to arrange for funeral trains to the cemeteries. We are to-day closer to the public than ever before. Many, if not all of us, have learned to appreciate the fact that the public is not to be beaten, and that we must conform to their wishes. The manager who meets with fairness and justice the demands of the public, and who trains his help to be gentlemanly and courteous to all, not only increases the receipts, but makes friends for his road of the riding public, the city officials and the press. I claim also that the best fender on the front of our cars is a clear-headed, careful man, of good judgment, to handle the brake and motor.

"The street railway now demands in every department the best ability that can be secured for it. Too much care cannot be exercised in selecting men to manage each department as well as to operate the road. This, in my opinion, is the one principle underlying the success of a street railway as well as of any other business enterprise. Competition and recent inventions have leveled the price of nearly all electrical apparatus and supplies to a commercial trade basis. Many of us can repair, and in most cases replace, a large percentage of our equipment in our own complete machine shops.

"The present demand is for a lighter motor and a flexible suspension of the motor to avoid pounding of the joints. I believe this can be obtained, and am pleased to learn that some of the companies are working in this direction. There is still work for the inventor. The extension of our roads into the country and the connection of a number of roads to form a large system brings up the questions of potential and feeders. We may look for some valuable experiments in the use of the alternating currents on street railway lines. This, in my opinion, is one of the most, if not the most, important and interesting subjects that confronts us at the present time.

"Many attempts have been made to produce power from compressed air, acids and numerous other agencies, but as yet none have been able to compete with electricity in economy and efficiency. However, we are ready to accept any innovation the ever-busy inventor may produce by which we can reduce the cost of operation.

"Our association has a very useful future before it. The street railways of the State have assumed such a magnitude that questions of vital importance affecting their interests are continually arising. These important issues can be met with advantage, both to the public and ourselves, only by united and harmonious organization, and I think we all recognize the benefits arising from a general exchange of ideas and plans."

Executive Committee Report.

J. P. E. Clark, who was elected temporary secretary, read the report of the executive committee, of which the following is an abstract:

"*Legislation.*—Upward of 30 bills pending in the Senate and Assembly of this State at one time, all of which, with very few exceptions, were obnoxious and adverse to the interests of street railways throughout the State, will enable you to form an idea of the activity during the past year of legislation affecting street railways and their operation, without questioning the good intent of the various members presenting these measures. Had half of the bills offered become laws, street railways would have been driven out of business. Energetic, prompt and persistent effort on the part of this Association and its active counsel undoubtedly aided materially in defeating a large number of the adverse bills. The presiding officers of this Association, together with the counsel and different members of the Association, appeared from time to time before the various committees of the Assembly and Senate, to whom these bills were referred, and in every instance were accorded courteous treatment and a polite hearing, and found only a disposition on the part of the various committees to treat all questions uprightly and fairly. With the increased number of representatives comprising the next session of the legislature, it is consistent to anticipate the presentation of an increased number of bills affecting our interest, therefore your committee urges the importance of the continuance and enlargement of this Association, so that united effort and concerted action may be obtained in considering and meeting the various issues as they arise. Increased membership and active interest in our organization will prove fruitful of beneficial results.

"*Special Work.*—The executive committee desire to commend the zeal and interest in the welfare of this Association and the street railway interests of the State at large, displayed by the officers of this Association during the past year. Their activity and good judgment have been productive of beneficial results. A vast amount of special work has been accomplished, and the various companies comprising the Association have been kept well informed of important issues as they have arisen from time to time by the numerous letters and circulars sent out from the headquarters of the Association, and the same have proven of great value to the individual companies and the Association as a whole. A great deal of active co-operation has been secured from different parts of the State and a constant interest in the Association maintained by their use, which should prove gratifying to us all.

"*Street Railway Journals.*—In submitting our report we feel that we should be remiss in the discharge of our duty should we fail to express the gratitude of this Association to the various street railway journals of the country for their hearty co-operation and the many earnest words written in behalf of street railway interests in general and their endorsement and encouragement of State and national associations. They are important factors in perpetuating and developing organizations of this kind, and their columns are devoted liberally to the reports of the various meetings and to the earnest solicitation of all street railways to identify themselves with association work. Aside from this the fund of information imparted by them is invaluable to all street railway men.

"*New Laws.*—Since our last meeting new laws of special importance, affecting organization, have been enacted, namely: Chapter 545 of the laws of 1895, amending section 59 of the railway law, so that street railway companies hereafter formed must obtain consent of the railway commissioners to build; also amending section 91 of the railway law, by providing that outside of cities and villages two thirds in consents of abutting property must be obtained; also Chapter 933 of the laws of 1895, which allows street railways to condemn property, except in cities. These are important measures which betoken the activity of the steam railways and demonstrate that they recognize the introduction of electric suburban roads as formidable competition.

"*Our Development.*—The growth and development of the street railway business of this State during the past year is extremely gratifying. Changes to electricity as a motive power are of frequent occurrence. Many new roads and numerous important extensions have been completed and are now under way. Numerous applications for new roads have been granted by the railway commissioners, prominent among which is a franchise to the Auburn Interurban Electric Railway to build from Auburn through Port Byron and Weedsport. This road is to be about 25 miles in length, and will be the first electric railway through a territory which in former years could only be covered by steam railways. The recent changes by steam roads to the trolley system all indicate a prosperous and extensive development of the street railway interest of this State which is pleasant to contemplate.

"*Obituary.*—In closing this report it is the sorrowful duty of this committee to chronicle the death of the beloved and esteemed secretary of this Association, Wm. J. Richardson, whose demise occurred at Brooklyn, N. Y., on April 26, 1895. In the removal of our associate, Wm. J. Richardson, the Association has encountered an irreparable loss and has been deprived of one of its most earnest and zealous workers. He at all times had the welfare of the Association at heart, and never faltered in the discharge of any duty that would enhance its interest."

TREASURER'S REPORT.

The report of the treasurer showed the following figures: Receipts, $7,286.57; expenditures, $6,299.76; balance, $986.81.

The following papers, which appear elsewhere in this issue, were then read: "Are We Laying Too Many Miles of Track to Reach a Few People," by W. W. Cole, Elmira; "Economical Equipment and Operation of Power-House," by H. S. Newton; "Car Heating by Electricity," by J. F. McElroy, Albany; "General Track Construction," by C. Loomis Allen, Syracuse; "Is a Freight or Mail Service Profitable or Unprofitable on Street Railways?" by Benjamin Norton, Newburgh; "Signals on Electric Railways," by J. H. Barnard, of New York.

The Association next took up the question of admitting supply men as associate members of the organization as recommended by the executive committee. After an animated debate, it was decided that the admission of the supply men at this time was inadvisable.

On motion of Benjamin Norton, of Newburgh, a vote of thanks was extended to President G. Tracy Rogers for the successful efforts he had made during the year on behalf of the Association. The convention also extended its thanks to J. P. E. Clark for his efficient work as temporary secretary.

ELECTION OF OFFICERS.

Officers for the ensuing year were elected as follows:

President, G. Tracy Rogers, Binghamton.
First Vice-President, W. W. Cole, Elmira.
Second Vice-President, John H. Moffitt, Syracuse.
Secretary and Treasurer, Benjamin Frick, Brooklyn.
Executive Committee: H. H. Vreeland, New York; John W. McNamara, Albany; Henry M. Watson, Buffalo.

EXCURSION AND BANQUET.

In the afternoon the visitors enjoyed an excursion to Troy. The trip was made in special cars provided by the Albany Railway Company.

The banquet took place in the evening at the Kenmore. President Rogers made the opening remarks, and introduced J. H. Stedman, of Rochester, who acted as toastmaster. Short speeches were made by Messrs. McNamara, of Albany; Norton, of Newburgh; Bissell, of Rochester; Senator Bradley, of Brooklyn; Cole, of Elmira; Frick, of Brooklyn, and McGraw, of New York. At the close of the banquet three cheers were given for John W. McNamara, treasurer of the Albany Railway, for his efforts in entertaining the visitors.

THE EXHIBITS.

The exhibits were arranged in a room adjoining that in which the business sessions of the convention were held. Among the exhibitors were the following:

THE NEW HAVEN CAR REGISTER, of New Haven, Conn., showed four of its fare registers. These included the standard single fare type, the Philadelphia or large dial type, that designed for registering two fares or single fares and transfers, and that designed for registering three different fares or two different fares and transfers. The company makes a special point of the fact that the figures of its ornamental registers are easily read. They have recently been placed in the 65-foot cars on the Nantasket Beach electric line, and it is stated that the figures can readily be seen the entire length of the car. A. N. Loper represented the company.

THE ROBINSON ELECTRIC TRUCK & SUPPLY COMPANY, of Boston, Mass., showed a model of its latest type of radial truck. This was equipped with models of the W. P. motors and ran on a curve bent on radii of 40, 32 and 25 feet. James W. Ripley, the company's representative, showed that with the Robinson truck the car took the curve as easily as if it had been running on straight track.

GEORGE C. EWING, of Boston, exhibited a number of samples of street railway supplies for which he is manufacturers' agent. He called special attention to the

Neal electric headlight, which is designed to be attached to the dashboard of the car. It is made of malleable iron, carries a parabolic reflector, and is illuminated by a 16-cp lamp. The headlight is now being attached to the cars of the West End Company, of Boston. There were also shown samples of the Ohio Brass Company's specialties, Phœnix Rubber Company's insulating paint, Mark Railway Equipment Company's specialties, Corning brake shoes, and a new trolley wheel designed by Mr. Ewing. A large photograph represented the Loring device for bending rails cold.

The Hughes Fare Register Company, of New York, exhibited its latest type of fare register, which is now well known to street railway men. R. W. Rose, the company's representative, called attention to its reliability, simplicity and other good features.

The R. D. Nuttall Company, of Allegheny, Pa., showed a number of its street railway specialties. Among the number was a handsome model of its trolley, which has given excellent satisfaction in service. Among other things there were exhibited sections of the company's special composition malleable gears, sections of open-hearth steel gears, samples of the improved malleable steel babbited axle bearing, to which special attention was called, and the improved Acme trolley harp and wheel. The following representatives of the company were in attendance: F. A. Estep, president, Pittsburg; Charles J. Mayer, Philadelphia; Charles N. Wood, Boston, and Elwood B. Sharp, Buffalo.

The Peckham Motor Truck & Wheel Company, of New York, exhibited an exceedingly handsome aluminum model of the side frame of the Peckham standard and extra long cantilever truck. The model was complete in every respect, and showed the construction of the truck in all its details. Photographs of the several types of trucks made by the company were shown. E. G. Long was the company's representative.

The Consolidated Car Heating Company, of Albany, made an elaborate exhibit of its electric heaters for cars. The types designed for cars of different construction were shown, and the arrangement was such that the principles on which the heaters are constructed could be seen to an advantage. To illustrate still farther the working of the heaters, the engineer of the company, J. F. McElroy, had arranged on an exhibition board a series of lamps supplied with current from the circuit of the Albany Railway Company. One of the company's five-point switches was cut into the circuit, and by its use current was thrown into the lamps in the same intensities as is supplied to the heaters. By the throwing in and out of lamps, and by causing them to become brilliant or dim by the manipulation of the switch, an effective illustration of the heating system was afforded. The exhibit was exceedingly interesting and well arranged, and attracted a vast deal of attention. The representatives of the company were: Charles N. Sheldon, general manager; H. N. Ransom, general agent, and J. F. McElroy, whose admirable paper on car heating appears elsewhere in this number.

The International Register Company, of Chicago, exhibited one of its new stationary registers, with its characteristic satin finish aluminum face. The type is well known to street railway managers generally, on account of its reliability and general excellence. The Boston agent of the company, Chas. N. Wood, was in attendance.

Wendell & McDuffie, of New York, showed a collection of photographs of the Taunton snow-plow and Taunton street sprinkler. At the present time the latter is performing excellent service. It is equipped with butterfly valves which are easily operated by the foot. The steel tank has a capacity of 2,700 gallons, which is sufficient for sprinkling four miles with a 20-foot spread or ten miles when the roadbed alone is sprinkled. R. L. McDuffie represented the firm.

The St. Louis Register Company exhibited two of its styles of register, both of which are highly commended by those who have used them. The company was represented by G. S. Allison and E. Packer, of the New York office.

The Johnson Company, of Lorain, O., had on exhibition a model of its Du Pont truck. The model represented in all its details the characteristic features of the well-known truck. The company's representative was L. E. Robert.

The Stever Rail Joint Company, of Cleveland, O., exhibited a model of one of their excellent rail joints. L. B. Collins represented the company.

The McPherson Sand Box Company, of New York, made an exhibition of two of its sand boxes which are simple, effective and easily operated. Both sand boxes were shown mounted on tables representing car platforms and the operation of delivering sand on the tracks was practically illustrated. Henry C. McPherson, the inventor, was present at the convention.

Delegates and Guests.

Following is a list of those present at the convention:

Allen, C. Loomis, Syracuse Street Railway Company, Syracuse, N. Y.

Allison, Giles S., New York representative St. Louis Register Company.

Ball, Franklin S., Jewell Belting Company, Hartford, Conn.

Barnard, John H., Interior Telephone Company, New York, N. Y.

Beard, W. K., New York representative of *The Car*.

Bissell, C. J., Rochester Railway Company, Rochester, N. Y.

Brady, Paul T., Syracuse Street Railway Company, Syracuse, N. Y.

Cahoon, J. B., Elmira & Horseheads Railway Company, Elmira, N. Y.

Clark, J. P. E., Binghamton Railway Co., Binghamton, N. Y.

Cleminshaw, Charles, Binghamton Street Railway Company, Binghamton, N. Y.

Cockey, Marston R., John A. Roebling's Sons Co., New York, N. Y.

Cole, W. W., West Side Railway Co., Elmira, N. Y.

Collins, L. B., Stever Rail Joint Company, Cleveland, O.

Cooper, H. S., Schenectady Street Railway Company, Schenectady, N. Y.

Crossman, T. E., Brooklyn, N. Y.

Crouse, J. B., Crouse-Tremaine Carbon Company, Fostoria, O.

Delany, W. H., New York representative General Compressed Air Company, Rome, N. Y.

Dickerson, J. W., Electric Railway Gazette, New York, N. Y.

Dodge, P. C., Wetmore & Dodge, Burlington, Vt.

Dutton, W. A., Dorner & Dutton Manufacturing Company, Cleveland, O.

Estep, F. A., R. D. Nuttall Company, Pittsburg, Pa.

Evans, H. C., New York representative Johnson Company.

Everts, D. T., Simplex Electrical Company, Boston, Mass.

Everts, Frank L., Utica & Mohawk Railway Company, Utica, N. Y.

Ewing, George C., Boston, Mass.

Fowler, F. H., Bemis Car Box Company, Springfield, Mass.

Frick, Benj., Atlantic Avenue Railway Co., Brooklyn, N. Y.

Goddard, S. H., *Electrical Review*, New York, N. Y.

Granger, John A., New York Car Wheel Works, Buffalo, N. Y.

Greene, B. E., *Electricity*, New York, N. Y.

Ham, W. F., New York representative of Johnson Company, Lorain, O.

Hanna, J. A., New York representative of McGuire Manufacturing Company, New York, N. Y.

Haskell, George M., J. G. Brill Company, Philadelphia, Pa.

Havens, W. E., Citizens' Street Railway Company, Fishkill-on-Hudson, N. Y.

Hunt, W. T., *Electrical Age*, New York, N. Y.

Issertel, Henry G., H. W. Johns Manufacturing Company, New York, N. Y.

Kneil, Thomas R., Saratoga Springs, N. Y.

Lawless, E. J., New York representative American Car Company.

Long, E. G., Peckham Motor Truck & Wheel Company, New York, N. Y.
Loper, A. N., New Haven Car Register Company, New Haven, Conn.
MacDuffie, R. L., Wendell & McDuffie, New York, N. Y.
Martin, T. C., *Electrical Engineer*, New York.
Mayer, Charles J., Philadelphia representative of R. D. Nuttall Company.
McElroy, J. F., Consolidated Car Heating Company, Albany, N. Y.
McGraw, J. H., *Street Railway Journal*, New York, N. Y.
McKeever, R. T., Johnstown Street Railway Company, Johnstown, N. Y.
McPherson, Henry, McPherson Sand Box Company, Troy, N. Y.
Medbery, H. J., Fiberite Company, Mechanicville, N. Y.
Meikleham, T. M., Randolph, Brooklyn, Queens County & Suburban Railway Company, Brooklyn, N. Y.
Mercur, Robt. J., New York Car Wheel Works, Buffalo, N. Y.
Morgan, Godfrey, Amsterdam Street Railway Company, Amsterdam, N. Y.
Morse, George C., Rochester Car Wheel Works, Rochester, N. Y.
Newkirk, H. R., Hoefgen, Moxham & Co., New York, N. Y.
Newton, H. S., Syracuse Street Railway Company, Syracuse, N. Y.
Norton, Benjamin, Newburgh Street Railway Company, Newburgh, N. Y.
Ostrom, J. F., Pennsylvania Steel Company, Philadelphia, Pa.
Packer, E., New York office St. Louis Register Company.
Pugh, D. W., John Stephenson Company, New York, N. Y.
Pugh, J. S., John Stephenson Company, New York, N. Y.
Ransom, H. N., Consolidated Car Heating Company, Albany, N. Y.
Ripley, James W., Robinson Electric Truck & Supply Company, Boston Mass.
Robert, Louis E., Johnson Company, Lorain, O.
Rodgers, J. K., Jr., Rodgers & Baldwin, New York, N. Y.
Rogers, G. Tracy, Binghamton Railway Company, Binghamton, N. Y.
Rose, R. W., Hughes Fare Register Company, New York, N. Y.
Rusling, F. O., Buffalo Railway Company, Buffalo, N. Y.
Russell, F. D., Rochester Car Wheel Works, Rochester, N. Y.
Sharp, Edward B., Buffalo representative R. D. Nuttall Company.
Sharpe, D. W., Newark, N. J.
Sheldon, Charles A., Consolidated Car Heating Company, Albany, N. Y.
Silver, Wm. S., William S. Silver & Co., New York, N. Y.
Smith, Charles H., Troy City Railway Company, Troy, N. Y.
Stedman, J. H., Rochester, N. Y.
Story, C. B., Hoosick Railway Co., Hoosick Falls, N. Y.
Strickland, E. A., Brooklyn, N. Y.
Vickers, Albert, Consolidated Railway Company, Syracuse, N. Y.
Vosburg, A. C., New Process Rawhide Company, Syracuse, N. Y.
Wallace, J. E., Smith & Wallace, Boston, Mass.
Wardwell, Fred S., Wardwell Bros., Danbury, Conn.
Wardwell, John S., Rome Street Railway Company, Rome, N. Y.
Washburne, Wm. A., New York representative Cambria Iron Company.
Wood, Charles N., Boston representative of the R. D. Nuttall Company

The Washington, Sandy Spring & Baltimore Electric Road.

It is stated that the syndicate of New York, Washington and Baltimore capitalists formed to construct a second electric railway between Baltimore and Washington has agreed to take an issue of $750,000 of 30-year 5 per cent. gold bonds, the proceeds from which are to be used in building the line. The company has been chartered in Montgomery County, under the name of the Washington, Sandy Spring & Baltimore Railway Electric Rapid Transit System. The syndicate furnishing the funds is composed of Allston Gerry and Nathan G. Miller, of New York, and James B. Colegrove and George S. Chase, of Washington.

The road will be in four divisions, including a branch westward to Frederick. Leaving Frederick the line will pass through Lime Kiln, Buckeyetown, Urbana, Hyattstown, Damascus, Etchison, Laytonsville, Olney and Sandy Spring to Ashton. At Ashton the Frederick division will end, and the Chesapeake division will begin. Leaving Ashton the Chesapeake division will pass through Ednor to Laurel Junction, thence through Stabler, Spencerville, Burtonsville and Scotchtown to Laurel, and through Prince George's County to Upper Marlboro, where connection will be had with the Washington & Chesapeake Beach Railway for Chesapeake Beach, upon the western shore of the Chesapeake Bay.

The Baltimore division will pass through Highlands, Clarksville, Doughoregan and Columbia to Ellicott City, and connection will be made with one or all of the electric trolley lines now in course of construction between Ellicott City and Baltimore.

The Washington division will start from Ashton and pass through Ednor, Colesville, White Oaks, Rapley's, McCullon, Rockdale, Lenox Park and Tacoma Park, where connection will be made with the Seventh Street trolley line to Boundary Avenue in Washington.

Probable Economies in Philadelphia.

It is announced that the Union Traction Company, of Philadelphia, into which the three great Traction systems are to be consolidated, expects to effect important economies by consolidating power stations. There are now nine stations of varying capacity. The Philadelphia Traction has four, the Electric Traction three, and the People's Traction two, one of which is the station at Ogontz.

The main stations of the Electric and People's companies are only about two squares apart on Delaware Avenue, and it has been assumed they could be readily consolidated by enlarging one and abandoning the other. The Hutchinson Street station of the Electric Traction Company could be done away with, and the Tenth and Eleventh Streets line, and other lines operated from it, could be operated from the Philadelphia Traction Company's central station, at Thirteenth and Mt. Vernon Streets.

The Sutherland Avenue station of the Philadelphia Traction Company and the South Street station of the Electric Traction Company, which are close together, could also be consolidated so that in the end there would be six power stations, each somewhat larger than at present, instead of ten. The saving in expense and maintenance by the "doubling up" described, it has been estimated, would amount probably to several hundred thousand dollars a year.

Not only can expenses be saved in this way, but the location of the stations can be taken advantage of. For instance, the Germantown and Chestnut Hill end of the Germantown Avenue line can be supplied with current from the Ridge Avenue and Dauphin Street power station of the Philadelphia Traction, which is at least two miles nearer Germantown than the People's station at the foot of Green Street. The Philadelphia Traction's station at Twenty-third and Market Streets could probably furnish power for all the West Philadelphia lines.

At present the Lombard and South Streets lines, in West Philadelphia, get their power from the east side of the Schuylkill. These and other changes of a similar nature would make a decided saving in power.

Boston Rapid Transit Subway.

The bids for the structural steel for the second section of the Boston subway were about 40 per cent. higher than those for the first section. Had the contract for the second section been made at the time the former award was made the saving would have been about $34,000. The bid of the Pennsylvania Steel Company of $58.70 per ton of 2,000 pounds has been accepted by the commissioners.

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CARS FOR TROLLEY PARTIES.

The success which has attended the operation of special cars for trolley parties in Philadelphia has been remarkable. The results would appear to indicate that managers generally are justified in devoting a great deal of time to the formulation of plans for increasing traffic of this kind. On one evening recently one of the Philadelphia companies took in as direct receipts from their special cars over $350, and the sums indirectly derived from the service was even in excess of this amount, for doubtless a considerable number of the passengers paid fares to and from the point where the cars were boarded. It is doubtless true that the conditions in Philadelphia are especially favorable to the development of traffic of this kind. There are few attractive resorts which the residents are inclined to visit in the Summer time, and consequently the new amusement instantly proved immensely popular. At the same time riding in rapidly moving cars is so generally attractive that there are few places where the trolley party cannot be made to yield a very substantial revenue. It is noticeable that the management of one of the Brooklyn railways has become so thoroughly convinced of the profitableness of the special service, after a few short weeks of experience, that it has determined to equip cars for the use of trolley parties during the Winter months. No such general demand for the cars will probably be made during the cold weather, and they will probably be utilized in much the same way as the parlor street cars in Boston. The fact illustrates, however, the importance which is attached to this class of service.

ELECTRICITY ON STEAM ROADS.

There is nothing unexpected in the official statement that the substitution of electricity for steam on the Nantasket Beach line of the New York, New Haven & Hartford Railway has proved eminently successful and has thoroughly satisfied the expectations of the management. Electrical engineers certainly have assumed that this would be the result as a matter of course. The third vice-president of the company, J. R. Kendrick, is authority for the statement that trains have been run much more economically, so that a greater number has been operated, and that the traffic compared with that of last season has increased about 300 per cent. No more striking endorsement of the operating system could be forthcoming. Thoroughly convinced of the advantages of electric traction, the company now proposes to extend the system other lines, and it appears certain that at least two sections of track will be equipped next season. It is undoubtedly the fact that in the near future the company will introduce the trolley system on parts of its line in order to meet the competition of parallel electric railways, from which it has suffered to a greater extent than any steam railway in the country. The attitude of the company is significant, as the managers of many steam railway companies have been watching with the greatest interest the outcome of what they deemed an experiment on the Nantasket Beach line. The great success of the installation, and the intention of the management to introduce the electrical system on a greater scale, will have its effect in leading to the application of electricity for the operation of similar roads in many parts of the country.

NEW YORK STREET RAILWAY CONVENTION.

In order that a street railway convention may be successful its executive officer must be willing to devote to his work a vast deal of perseverance and enthusiasm. It may be assumed that the president of the New York Association entered upon his duties in this spirit, if one may form an opinion from the gathering at Albany on Tuesday last. The programme had been well prepared and persons ready to treat the live subjects which had been selected were present at the sessions. Real interest was infused into the meeting, and the discussion would have given evidence of the importance attached to the topics had it not been that the time for adjournment made it necessary to abridge it materially. The papers which were presented were in the main excellent, short and to the point. The only surprise is that so much matter could be crowded into the limited time allowed for the literary proceedings. The attendance was not so large as had been expected. Quite a number of members who had given assurances that they would be present were detained at the last moment. With this exception the meeting may be regarded as successful in all respects and may be considered a fitting close to an admirable year's work. It is worthy of note in this connection that the Association does not limit its season of activity to a day or two annually when it gathers in convention. Throughout a considerable portion of the year its officers labor for the protection of the mutual interests of the members. Particularly have they been active in watching State legislation relating to street railways. During the last session of the legislature there were at one time no less than 32 street railway bills introduced so prejudicial to street railway interests that had half of them been adopted companies would have been actually driven out of business. This statement is made on the authority of the executive committee, which certainly should not make any unconsidered assertions. The officers of the Association distributed information regarding these obnoxious measures, and at different times caused representative men to appear at the hearings in opposition to the bills. In this way most of this threatened hostile legislation was prevented. We believe that the warmest thanks of street railway men generally are due to those who have been active in this work, for action taken by the New York legislature on a street railway question is likely to influence legislation in other quarters. The Association has made an admirable record, but it has not been supported as it should have been. According to the figures given by President Rogers in his address, the street railways of the State represent an investment of $200,000,000. Such a gigantic interest certainly should be represented by a powerful organization wielding an influence which could make itself felt in these days of hostile legislation toward corporate property. We certainly trust that the New York State Association will receive far more cordial support in the future, and that its next convention may be even more interesting and significant. At the present time its plan of work may be studied to advantage by those interested in similar organizations in other States.

Electric Traction on the Old Colony System.

The electrical operation of the Nantasket Beach line of the New York, New Haven & Hartford Railway has proved so successful that the company proposes to introduce the system on a large scale. It will extend the Nantasket line's special equipment over on to one of the main lines of the Old Colony system from Nantasket Junction to Braintree. This section of road will be provided with four tracks, the two inner ones of which will be fenced in and used by the steam trains, while the two outer ones will be used by the electric cars. The company expects to have this line in working order by the first of next season. Futhermore, it has been practically decided, says J. R. Kendrick, the third vice-president, to use electricity in conjunction with steam as far out as Readville and Dedham, on the Providence division, in the same manner as between Braintree and Nantasket Junction.

Passing of the Locomotive.

There is something almost pathetic in the spectacle of the steam locomotive engaged in a hopeless fight with the all-conquering trolley, remarks a writer in *Harper's Weekly*. We can all remember Mr. Ruskin's diatribe against railways, and there are some of us who can go back to a day when it was a distinction to have been a European traveler. A man who had made the grand tour was familiarly known as a Hadji, and presumably entitled to the privilege of wearing a green turban, if it so pleased him. And then came steam, which changed all that; and now it is electricity, and piston-rods and cylinder-boxes are doomed to swell the dust heap along with the post-horns and leathern curtains of the stage-coach.

The trolley is cheaper and more effective, and that tells the story. Where we used to build branch railways we now put up a trolley line, saving both in initial cost and in subsequent operating expenses. Road wagons and private carriages to run independently over a system of trolley lines extending in a vast network throughout creation are a possible feature in the near future, and in the meantime experiments are being made on the trunk lines looking toward an entire change in motive power.

New Use for an Electric Car.

An electric car was utilized in New Hudson a few days ago for drawing an injured telephone from the conduit. The workmen were not strong enough to move it, and a pair of horses was unable to stir the cable. An electric car on the Fair Haven road was impressed into the service and the cable was withdrawn without difficulty.

Economical Equipment and Operating of Power-House.*

BY H. S. NEWTON.

H. S. Newton.

A modern electric street railway station, to deserve the name in these advanced days, should embrace in the details of its construction those features which experience has shown to be best adapted to the service required. These details, I take it, are such as would be included by all engineers in a compound-condensing station. A preference has been shown by some engineers for certain additional features, by others for features differing considerably in the means toward the end. It is not my intention to enter into a discussion of the relative merits of different apparatus, or the wisdom of different methods, but I shall confine my remarks to the ways and means which we have considered and have adopted in our power-house lately constructed at Syracuse.

The Syracuse Street Railway Company's plant is made up of three double-compound engines of the upright, marine type, having cylinder dimensions 16½ x 31 inches, with a 24-inch stroke. These are belted direct to multipolar generators of 300 kw capacity, and exhaust each into an independent surface condenser. The condensed steam from the condensers is pumped through an oil filter or separator into a hot well, from which the boiler feed pumps convey it through a pipe heater to the boilers. By this arrangement not to exceed 10 per cent. of the boiler feed-water is taken from the outside water supply, and all difficulty with scale is practically overcome.

The boiler-house contains five 90-inch tubular boilers, 16 feet long, each made up of 118 four-inch tubes. These are fed by a pair of pumps, one acting as a relay to the other. The whole plan has been in operation only a few months, and it has been impossible as yet for us to make an accurate test as to its economy. Our coal and water bills have demonstrated the fact, however, that we are making power at a low rate, and this, with the additional fact that we are having an entire absence of trouble, are all that I can urge as an excuse for this paper.

The feed-water is introduced into the boilers through a line of 2½-inch piping connected to duplicate pumps through a pipe heater. We have found two objections to hold against the arrangement as adopted, the correcting of which, I feel, will influence somewhat the economy of the station.

The first of these is the fact that in covering the live steam pipes it was not deemed necessary to cover those carrying the warm water to the boilers. This leads to a difference of some five or ten degrees in the temperature of the water when leaving the heater and when entering the boiler, and is, consequently, a source of some little loss.

The second point is the absence (since remedied) from the feed-water line of a check valve beyond the pumps to relieve the check valves at the boilers. This would seem to be of small importance if not absolutely unnecessary, but we have found it of decided advantage in prolonging the life of the valves and doing away with the rattle occasioned in these valves by the pulsations of the pumps. An air chamber over the pumps is also of prime importance in lending elasticity to the system.

In this connection I wish to call your attention to the importance of an injector on each of the boilers. There seems to be a growing tendency to rely entirely on a relay of pumps, thus allowing the operation of the station to hinge on the efficiency of a piece of apparatus which my experience goes to show has a decided tendency to get out of order.

Concerning the economy of using over and over again for boiler feed the condensed steam from the engine exhausts, a great deal may be said. The surface condenser, the necessary adjunct to this practice, is not a particularly rare piece of apparatus, but I find that a surface condenser which is called upon to perform this one of its functions is decidedly uncommon in street railway practice. In numerous stations it is used to obtain a vacuum, but in very few is the water of condensation utilized. The character of the water around Syracuse made it very desirable that we should utilize the condensed steam if possible, and after what promised to be some very disastrous experience, we have at last succeeded and are running very successfully, as mentioned before, with over 90 per cent. of our feed from this source.

Our immediate result on starting this practice was oil in the boilers, or a mixture of oil and dark-brown sediment, which caked over the bottom seams. We removed this and tried again, concluding that it might be shop grease and dirt. Again we had the same result. Examination of the oil filter showed nothing out of order, and consultation with the engine builders evolved nothing new. After endless experimenting, resulting in a leaky boiler or two, and the consumption of a vast amount of chemicals, we have located and remedied the trouble to our entire satisfaction.

The accumulation noticed seems to have been the result of three causes :

(1) The use of too much cylinder oil.

(2) The use of the wrong kind of cylinder oil.

(3) Insufficient filtration of the oil from the feed-water before going to the boiler.

The first of these causes was, of course, soon remedied, and the old-fashioned notions of our engineers were shocked with the order to use only three drops a minute for each engine.

The second cause we were longer in discovering the remedy for. Various expedients were tried for cutting up the grease in the boilers, such as carbonate of soda, soda ash, tri-sodium phosphate, and, lastly, kerosene oil. None of these expedients proved effective, however, and it was not until we changed our cylinder oil that we solved the problem. We purchased some oil of purely mineral stock, which has worked so well as to lead me to conclude that it must have been the animal fat in the other oil which was doing the mischief. We are using this oil to-day with remarkably good results, never more than a slight film being apparent in the boilers at the time of the weekly cleaning, and this readily succumbing to the action of a half pail full of soda ash pumped in with the feed-water before cooling off.

The third cause of trouble we have recently largely overcome by introducing a number of partitions in our oil filter, by means of which the water is caused to flow alternately over the top of one end under the next, in this way allowing the oil to settle, from its water emulsion, and be collected in the excelsior filling.

The factor that after all has seemed to be the strongest in the solution of our problem in economy is the choice of fuel. We have done quite a good deal of experimenting in this line with various grades of coal, and the results obtained have been such as to lead me to very strong conclusions.

The best coal, and by that I mean the cheapest fuel, we have found to be anthracite buckwheat, costing, on board cars at our station, $2.25 a gross ton. The dust anthracite, I find, will sift through the bars. When mixed with an equal amount of soft coal, it works very well, but necessitates the help of an extra man as mixer, and is not so economically fired. We use 13 tons of buckwheat a day, where it was necessary to use 17 or 18 of the mixture.

A great deal has been written, and a great deal more said about the efficiency of special devices, such as high and low water alarms, automatic damper regulators, etc., in the boiler house. Our experience with them has been most satisfactory. We have found that the less responsibility you place on a man who shovels in your coal, the better off you are in the end; or, in other words, that as compared with human brains, the mechanical device is at a big premium. By making the engineer responsible for the operation of the devices and keeping them in repair, you are insuring yourself a great deal better boiler-house economy that you could not otherwise expect to obtain.

The vertical marine type of engine has given us thus far very good service. The most serious objection that we can urge to them is that they are noisy. In order that the vertical cross-head guides may not be subjected to too serious wear, we have found it necessary to lower the compression below the point usually employed. The natural consequence is more wear in the cross-head crank bearings and more noise. With more compression we get cross-heads and guides, and we consider that we have chosen the lesser of two evils.

Our engines are provided with piston valves for the high-pressure, and grid-iron slide valves for the low-pressure cylinders. They will govern to within 3 per cent., or about as well as the Corliss. I don't think the true importance of good engine government is recognized by street railway men. One is apt to regard a badly governing engine merely as an inconvenience resulting in slower speed on the cars and dim lights. The additional loss of power on the line, viz., in the feed wires, trolley wires and rail return resulting from the decreased voltage at the station is often entirely lost sight of. A few figures on this point might be interesting. Given a station with generators compounded for a constant potential of 500 volts, with constant speed on the engines, and a system of feeders allowing for an average loss on the line of 10 per cent., with full load on the machines. With our engines governing perfectly 10 per cent. is lost in transmission. If they slow down as the load comes on so that the dynamos show only 450 volts, with the same watt output, over 12 per cent. of the total energy will be lost in transmission. With 400 volts on the machine over 15 per cent. will be lost. Therefore, when we couple with these facts the consideration of loss of light and decreased efficiency of motors at the lower voltage, it is plain that too much importance cannot be given to the government of prime movers.

In conclusion, I cannot refrain from adding one more voice to the cry against cheap labor in the power-house. What help of that kind we do employ, and we are not extravagent, I assure you, is used in a subordinate capacity. Our present engineer in charge was employed after a very clear demonstration that a cheap man was not capable of handling the plant. A condensing station, with the volume of detail which must be always present in its construction, requires brains for its operation; and the man with brains commands good wages. The pressure that is brought to bear on the management for reduction of wages in the power-house is often severe, as I can testify, but the moment the concession is made the trouble begins, and a shutting down for repairs on your road becomes a common occurrence.

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*Read before the Convention of the New York State Street Railway Association in Albany, Sept. 17, 1895.

DISCUSSION.

The President : This paper is entitled to a thorough discussion.

Mr. Ostrom : I would ask if the vertical type of engine gives the same facility for examination by the manager. Mr. Newton has a good engineer, a man with brains, as he says, which many companies lack. I have heard in my travels quite severe strictures made on the vertical type of engine on the ground that the engineer will not go up and down stairs to oil it, and the manager in passing through the room has difficulty in seeing if the work is being done properly, as well as he could with the horizontal engine.

Mr. Newton : I can only say in regard to that, if you should have lazy engineers, that the objection holds most decidedly; but with the class of men we are employing at present, we have had no trouble at all. Still, for several years it has been my practice in my visits to the power-house to go up on the deck of the engines—the decks of the three engines are all connected—and walk through, paying some attention to the lubricator ; and I generally use my ears. At first we had a cheap man to begin with, and had some very serious trouble at the outset, but since the present man has been in charge we have had very little to complain of ; and as far as the facilities are concerned for the manager to go over the plant, it also requires a manager who is not lazy.

Mr. McNamara: I would like to know how many cars they are able to move in Syracuse with 13 tons of coal; also what the pay of the engineer and fireman is. I know you have one line with a pretty stiff grade.

Mr. Newton: We have one line which has some very severe grades, one of which is an 8 per cent. grade with a curve thrown in. We are running about 38 cars on that amount of fuel. The wages paid the chief engineer are $100 a month, which we consider very good pay in our section. (Applause.)

Mr. McNamara: How many hours ?

Mr. Newton: He runs 12 hours; we have two shifts.

Mr. Rogers: What is the price of coal ? what does that 13 tons mean in dollars and cents ?

Mr. Newton: $2.25 a ton.

Mr. Barnard : Does not the use of the surface condenser lead to foaming in the boilers ? How much does the use of the surface condenser save in the water tax ?

Mr. Newton : We do not have any foaming ; we had some at first, but that has disappeared.

Mr. Barnard : About how much saving does the utilization of about 90 per cent. of your feed-water amount to ? In a great many cities the water rents are quite a large item ; and when you avoid using 90 per cent. of city water it ought to effect quite a saving.

Mr. Newton : We should not use city water ; we use it from the Erie Canal which flows past the station. It is seriously impregnated with salts, and it is more on account of that than anything else that we adopted the surface condenser. You understand that the exhaust from the engines runs through this surface condenser, and is condensed into water ; that water is pumped through a filter, an auxiliary filter, with these compartments in it that I speak of, direct into the boilers through a pipe heater, and we obtain from the hot well very warm water in the first place, and we really require very little heating capacity in the heater.

Mr. Barnard : Does the injector handle the feed-water at the temperature obtained in the hot well without trouble ?

Mr. Newton : That is one of the points in which our station is lacking; we have no injector. My former practice, however, would lead me to think it would feed it all right from the hot well without any of it going through the heater.

Mr. Cahoon : I would like Mr. Newton to give the steam pressure at which he operates, and the make of the boiler ?

Mr. Newton : We are operating at 116 pounds at present. The boilers are built for 120 pounds pressure. The make of the boiler is the marine tubular boiler, made by the Cleveland Ship Building Company, Cleveland.

Mr. Cahoon : I think, possibly, in regard to coal, that the steam pressure has a good deal to do with the class of coal to be used. We made a long series of experiments on the use of various forms of anthracite and bituminous coal. We are using 160 pounds pressure, with compound condensing engines for the railway and triple expansion for lighting, and we found that the Eureka Clearfield coal gave the best results. That costs us $2 a ton.

Mr. Rogers: Where is your plant located ?

Mr. Cahoon: Elmira. We get our power from the lighting station; the railway and lighting company are both owned by the same parties. We get, perhaps, an advantage from the union of the two interests.

The President: A comparison of the cost of fuel would undoubtedly be interesting, as this is an important factor in the consideration of the subject.

Mr. McNamara: In the case last cited, the gentleman gets his coal at $2.00, which would cost us $3.25 in Albany; not less than $3, certainly. Buckwheat anthracite in Syracuse is $2.25; we cannot buy it as cheap as that.

Mr. Clark: We use in Binghamton what we call bird's-eye coal. It is a size smaller than buckwheat, washed clean and bright. We have been using that with a high degree of success; it costs $1.65, gross, f. o. b.

Mr. Cahoon: We made most of our experiments with bituminous coal, because operating at that high pressure, and having vertical tubular boilers, we found our anthracite coal fired badly and did not give good results. We tried various forms of bituminous coal, many of them from the Clearfield district. I think the cheapest grade was $1.60, but we did not get anywhere near as good results as with the Eureka at a higher price. We get it landed in the bin at $1.95, and it costs us about 5 cents more to get it to the fire-room, because we have to carry it in a cart some little distance.

Mr. Rogers: What does it cost you for fuel, Mr. McNamara ?

Mr. McNamara: We pay $2.50. We can operate about 50 cars at the same coal consumption, but not as cheaply, because we have to pay more. Our power-house pay roll is larger than in Syracuse, as we have eight-hour watches. We do not pay as high wages, but employ more men.

Mr. Cahoon: I would like an expression as to actual cost per kilowatt-hour, if any gentleman has it figured out—the cost of power delivered to the line, per kilowatt-hour. I have some figures from several stations out West and through various portions of the country, and the cheapest that I could see was 1½ cents per kilowatt-hour, which came from Toledo. That is the cost delivered on the line.

Mr. Rogers : In Binghamton I think our coal cost $4.70 a day in June, and something over $6 a day in July, to operate anywhere from 20 to 30 cars. We take our water from the river, and have our grates arranged so that we can use dust mixed with Buckwheat and Bird's-eye coal.

Mr. Norton : How many tons a day for the 20 cars ?

Mr. Rogers : I did not get the tonnage ; the value of the coal was as stated.

Mr. Clark : The average was about eight tons ; about 60 per cent. dust and 40 per cent. coal ; averaged about 27 cents in the yards.

Mr. Cahoon : What kind of boilers ?

Mr. Clark : Horizontal.

Mr. Cahoon : Operating at 100 pounds pressure ?

Mr. Rogers : Our boilers were specified to carry 125 pounds steam ; we use them at 110.

Mr. Newton : I would like to ask Mr. McNamara if you have any unbonded track on the line, or any poor flat rail ?

Mr. McNamara : Not that we know of. (Laughter.)

Mr. Newton : The reason I ask is I think we get good results under the circumstances. About half of our mileage is old flat horse-car rail, and we have never attempted to bond it. We did not think it was fit to bond, and have run an overhead rail feeder along on the poles and tapped in every now and then, and the result is there is a large amount of power lost ; and that is the only ground on which it is possible for me to account for the increased economy in your station over ours.

Are We Laying Too Many Miles of Track to Reach a Few People ?*

BY W. W. COLE.

It is an established fact that as the mountain would not go to Mohammed, he had to go to the mountain. The fact is just as self-evident in the location of track, that if you stop one block from where the dividing line comes, between the settled district and the open field, the people will walk that one block to the cars; and the maintenance and operation of 1,500 feet of track for one year on a 15-minute headway, at 9 cents per car mile, means the interest at 5 per cent. on $26,864, or $3.68 per day. It can be readily seen that with many lines extended just beyond the line of population, that the road has extended just beyond the line of dividend. It is conceded by all that when a new line is constructed, that we have to educate the people to ride, as they have become accustomed to depend on their horse or bicycle, or to walk. Now, if we extend our lines beyond the population, we immediately become a professor of education, as we must not only educate the existing population to ride, but must educate the people to build on the open territory and educate people to move into the houses built. If we keep within the lines of existing population, we have the advantage of a general located on an eminence—we can wait and see which way the population army moves, and then we make no mistake in our extension. In other words, the railway is practically the army sutler, and there is no instance where the sutler led the army.

W. W. Cole.

There is no denying that a railway extended into open territory will increase the value of real estate, and eventually build it up; but, in the meantime, we are wearing out rolling stock and track for the owners of real estate, and should receive a bonus sufficient to carry the road until the open territory is sufficiently populated to support a road.

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*Read before the Convention of the New York State Street Railway Association in Albany, Sept. 17, 1895.

It is the general experience that by the time the fields become populated, the rolling stock must be replaced, and the track repaired, or we practically build a new road to suit the new condition, and outside of the benefit to the real estate owners, we only get our returns when the new road is built for the actual needs of the existing population.

A road built in an unpopulated district has to contend with more dust and mud upon its rails, which means wear and tear, and without sewers there are bound to be places in the track where it will be covered with water, which is deleterious to motors, track and car bodies.

We will cite as an illustration a city of 40,000 inhabitants, which has 20 miles of track; five of the city lines extend 2,112 feet beyond the settled territory, or two miles of track, with but little traffic. Taking an average of 10 cities of 40,000 population, the riding per capita is 46 times per year.

This would give, in gross receipts, $92,000; operating expenses, 70 per cent. of gross receipts, or $64,000; and $27,600 net receipts. The average road is bonded at the rate of $30,000 per mile, or $600,000 for 20 miles of track. The interest at 5 per cent. would be $30,000. This would show a deficit of $3,400 on interest.

Now, in this city of 40,000 inhabitants, we have two miles of track operated and bonded that for the present we get no returns from, as it was built to promote the building of the city at different points, and, like the man who has lived a good life on earth, we are looking forward to a future reward; but the man is invariably dead when he receives it, and the results in street railwaying show that they are waiting for the sound of the horn in the hands of the receiver.

In this city of 40,000 if but 18 miles had been built and bonded for $540,000, with an annual interest of $27,000 we could have shown at least $600 surplus, and with the modern methods of increasing traffic, this surplus could undoubtedly be increased to pay the stockholders a fair rate of interest, if 18 miles were built instead of the 20.

If for obvious reasons it becomes necessary to extend the track beyond the populated limits, care should be taken to focus the promoting energy upon one line, and to extend no other lines until the one so extended has been so populated that that line shall be self-supporting, as with the extension of several lines in different parts of the city the various interests become separated and each line so extended only receives a very widely scattered population, that must take years to promote into a paying territory.

Precaution must be observed in running out suburban lines for park and pleasure resorts, as we can only count on three months of pleasure travel, and a line built for pleasure travel only is apt to prove a problem with an unknown quantity. On the other hand, all parks and pleasure resorts introduced along existing lines, even though built at a considerable expense, if properly managed, will prove a booster to the net receipts of the lines favored.

In locating pleasure resorts, if possible, they should be placed on lines connecting two towns, as then you promote traffic in both directions, and are not to a large extent paying for an empty mileage in one direction; and you are also promoting traffic to the thinly populated section of your road.

To clinch my argument I will quote from an editorial in the *Street Railway Journal:* "That the total street railway mileage of the United States is approximately 6 per cent. of the steam railway mileage. About 6 per cent. only of this mileage is at present in the hands of receivers, as against about 25 per cent. of the steam railway mileage. The gross earnings of all American street railway properties are probably slightly less than 15 per cent. of the combined freight and passenger earnings, but are nearly 50 per cent. of the passenger earnings alone of the steam railway properties, while the net income applicable to dividends on capital stock is hardly less than 35 per cent. of the steam railway income. These results are surprising, indeed. That 14,000 miles of street railway track should be able to earn half as much gross on passenger traffic, and one third as much net (for dividends) on combined passenger and freight traffic, as is earned on 234,000 miles of steam railway track; this is certainly a remarkable showing, and one which points to a very reasonable cause for capitalization per mile of track larger for the street railway than for steam railway properties."

When we have carefully considered the subject of this paper, "Are we laying too many miles of track to reach a few people?" the results of a comparison between the steam and street railways are not so surprising, as there is no doubt, if the cities could all be moved within a few miles of one another along the lines of the steam railways, that their passenger receipts would show an immense increase, and a corresponding decrease in operating expense.

Even though the steam road charges 3 cents a mile and the street railway often gets less than 1 cent a mile, we find that the receiver's hands and pockets are being filled by the steam roads, because, even at 3 cents per mile, enough passengers must be carried to support a lengthy mileage through the unpopulated country.

Is a Freight or Mail Service Profitable or Unprofitable on Street Railways?*

BY BENJAMIN NORTON.

The simplest answer to this question is: Yes, if it can be performed at a profit; and No, if it must be performed at a loss. Now, apparently the question is solved, and I have no further need to discuss it. But as this is a subject which will eventually be taken up seriously by most electric railway companies, it is worthy of very careful consideration.

BENJAMIN NORTON.

On a street railway which has no suburban outlet and no direct or close connection with some other line which operates or can conveniently operate a freight service, it might be a very unprofitable venture to undertake this class of traffic. To-day, however, there is hardly an electric railway (and we will speak of electric roads only now, since horse power is a thing of the past,) which does not have suburban outlets or chances for them. Therefore, we may safely say that a freight service, as a general rule, ought to pay. Very few companies thus far have branched out into this field, and as I happen to be interested heavily in a line which has gone vigorously into the matter, I can tell briefly our experience and can show you what a successful feature of our business the freight branch of it is; so much so, that we have a regularly organized freight department, waybilling merchandise in regular steam railway fashion and running regularly scheduled freight trains, which pay handsomely.

This line grew out of a tumble-down horse railway in Newburgh, and after being rebuilt and extended and equipped electrically we found ourselves tapping the rich Walkill Valley at Walden, 12 miles away, and terminating at the front door of one of the largest cutlery works in this country, running by all the stores and shops in town, and giving an opportunity besides to dairymen of Orange County to get their milk, butter and cheese to boats on the Hudson River at Newburgh inside of an hour, when formerly they had carted it the whole distance over rough country roads, the teamsters spending pretty much the day at it and returning home at night, with their mule team tired out and often a broken-down wagon.

This line to-day, because it is a short cut in the first place, and because goods can be transported at low rates in the second place, is handling the dry goods and other merchandise for Walden merchants, shipped from New York to Newburgh by boat; the raw material for the cutlery works in the way of steel, brass, wood and other supplies, and bringing back manufactured material in cases; hay, straw and fruit, and condensed milk in cans from the Borden condensery, only two miles from our terminus at Walden. The road runs along the highway in some portions, and at other points the line is set well back from the roadway on independent property; and the farmers hustle their hay and straw in bales out the side gate to the track and stop the freight car handily, saving, besides 50 cents to $1 per ton freight, a long drive to the steam road, freight house. In August the operating cost for handling our freight was a trifle over 40 per cent. of the gross receipts. We ran three motor freight cars, carrying from eight to 12 tons each, and four flat or gondola cars as trailers, carrying from six to eight tons each. At Newburgh the line runs alongside the string-piece of the steamboat dock, so that everything can be easily skidded between the boats and cars. We also run close to the Erie & West Shore freight houses and tracks, ensuring an all-year-round New York connection, although, as a rule, the Ramsdell line of boats is out of service but one month in the year.

Some of our Walden friends remarked the other day that the Walkill Valley Railway people had "soured on the trolley," because their freight trains in both directions were running through Walden without stopping, and they were discussing the notion of discharging their freight agent at that point. I may add that during the past week we have hauled from Walden to the Hudson River, among other kinds of freight, about 75 tons of grapes, and the coming week we will do the same. The rate of 13 cents per hundred pounds net to us makes $2.60 a ton, which is a good rate, and requires but one trip per day of a motor freight car and trailer to get it. To earn the same amount of money with passengers would take the entire day and a regular full day crew besides.

The experiments now being made by the New Haven Railway people on their Nantasket Beach road are probably not new to you, and it looks very much as though freight business on electric roads would not only be profitable in the near future, but generally adopted as a means of revenue by a large percentage of such companies.

As to mail contracts, while the government compensation is comparatively small, the actual cost to a company for performing the service is so little that they must be profitable to a certain extent, but, aside from this, no large corporation in a large city where the circumstances call for such a contract, should overlook a special safeguard in time of strikes. During my presidency of the Atlantic Avenue Railway Company in Brooklyn, we undertook to serve the government in this regard and prepared special cars. Part of these cars were devoted to mail matter and mail clerks and part to regular passengers; so that while they were on the line they were earning money for the company from the passengers, the same as other cars, and at the same time the U. S. Mail sign always insured a clear track. Our experience during the strike of last Winter proved conclusively the value of a government contract for carrying the mails. The 19 cars on our Fifth Avenue line, which, under the contract, were permitted to carry the legend "U. S. Mail," were not molested, and we were able to keep that particular line open throughout the whole trouble. In view of all the circumstances, I believe a mail contract for a street railway is one of the most profitable things, for a small one, that they can undertake.

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*Read before the Albany convention of the New York State Street Railway Association, Sept. 17, 1895.

DISCUSSION.

Mr. Meiklehan: I would ask the gentleman how he arranges to collect his freight without interfering with his passenger traffic?

Mr. Norton: If you were running cars on four-minute headway probably there would be some trouble, but where we run once an hour, between Newburgh and Walden, we have ample time, particularly as the line runs through the main street, and the stores are all located on that street. It never interferes with the passenger service. We have a general freight house in Walden, with a siding, where freight is delivered during the day. We have our freight trains arranged on a regular schedule, and some of it is collected along the line of the road. Of course, a great deal of it is delivered at the freight houses.

Mr. Meiklehan: You say, if it does pay, it pays. Do you not think that the line is drawn at the point of the ability of the road to deliver and receive? In 1888 a road in Norristown undertook to do that work and made a great deal of money out of the freight service, but the trouble came in at the point of delivery. We were expected to take a package to anybody along the line, and its delivery might require skids to get it to the door, and the delay was found to be very annoying. If we could have certain points at which to take up and deliver freight, we could put in sidings, and the matter would be simplified.

Mr. Norton: Most of our freight is sent through from one point to the other. We have comparatively little intermediate freight in the 12 miles between the two points. Most of the firms who send their freight are within easy reach of the freight houses, so that we have not had any inconvenience in receiving or delivering freight.

Mr. Meiklehan: That is the question; whether you can get such freight in sufficient quantities.

Mr. Cole: Have you made any arrangements for carrying letter carriers at a cheap rate?

Mr. Norton: We have not taken the matter up largely with the postoffice. There happens to be one instance that I think of where we do transport the mail carrier, on a route which is, perhaps, a little longer than the average—out to West Newburgh. We let him ride both ways free—two round trips each day, to collect and deliver mail.

Mr. Cole: Some years ago I was connected with the Utica Belt Line road, and we made arrangements not only to carry the mails, but received a stipulated sum for transporting the mail carriers; it cost about 3 cents a man.

Mr. Norton: We had that arrangement in Brooklyn; it is in vogue now. The fare was 3 cents. I understand it is 4 cents now.

Mr. Cole: At Utica we carried a sign on all the cars, "U. S. Mail," whether we had it on the car or not.

Mr. Norton: You were authorized to carry the mail on your system?

Mr. Cole: Yes.

Mr. Norton: There is no question about the right to carry the signs. We had in Brooklyn two cars arranged like the regular railway mail postoffice, on the long line to Coney Island. We had a side track into the General Post Office in Brooklyn, the mail was put into the cars, and the mail clerks went along and distributed it, and they picked it up and sorted it in the car and delivered it at various stations. The West End Division of the Atlantic Avenue system was formerly a steam road and they had a regular government contract to carry the mail. When we changed it over to electricity we carried on the contract. I do not think there is any other road, unless it is in St. Louis, where the service is performed in that way, as a regular railway mail post office. Many of the cars in most cities are allowed to carry signs simply to pick up mail bags and move them from point to point, but in Brooklyn the mail is regularly sorted in cars on the road.

Mr. Cole: I think it is so in Boston.

Mr. Ostrom: Also in Philadelphia.

Mr. McNamara: We have been operating for over a year a freight line between Albany and Troy; an interurban freight line. We have a freight house in Albany and one in Troy; we do not aim to take up packages on the way; it is a through freight line. We have been operating it for a year, and are going to continue.

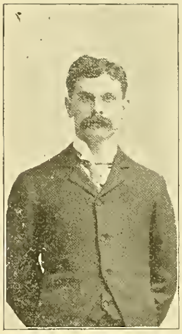
Mr. Norton: Have you any special provision in your franchise which authorizes you to carry freight?

Mr. McNamara: We are operating this freight line on a leased line which was chartered to carry freight, otherwise we could not do it.

General Track Construction*.

BY C. LOOMIS ALLEN.

The evolution of track construction for electric service from that of horse cars has been very rapid, when considered with the length of time it has taken the steam roads to reach the point of excellency which many of them have attained. In fact, some of our electric roads can show permanent way equalled by but few of the steam roads.


C. Loomis Allen.

The days of stringer—box girders, three point or butterfly—light girder and light tee rail sections have passed away to make place for the deep girder or deep tee rail sections; the former being used in cities and villages of some size, the latter in country roads and small towns. In the transformation of motive power of a railway system from horses to electricity or cable, the last department—generally speaking—to receive any outlay or money is the track department; and then only when the car repair bills and track maintenance are so costly as to demand an investigation, and its consequential repairs. Many of you who have passed through this experience can remember how heavier rails and stronger joints alone was the prescribed remedy, which, when applied, was found to be only temporary, and poor track the results after a few months of operation. It has been only recently, and after very costly experience, that any attention has been given by street railway officials to the matter of foundations, or to the conditions of the sub-grade upon which is placed the ballast, and I am sure that experience will bear me out in my statement that economy in track maintenance begins with the making of firm foundations.

A great many obstacles are encountered in finding firm foundations for electric roads, with which the steam roads do not have to cope. Let me cite a case which in cities is very common. A street is about to be paved with permanent pavement, and the street railway officials having secured the best of track materials, propose to lay permanent track. Having decided upon the plans of construction, they enter upon their execution. The first work is the matter of excavation of the material in the street to sub-grade, as is generally the case, the sewers, water mains, gas mains, electric conduits of subways have been previously constructed a sufficient length of time to allow the trenches to settle—the popular idea is that one winter will settle trenches—the surface of the street seems firm and fairly solid; excavation progresses to such depth as is desired, and the rolling of the sub-grade with a heavy roller, to make thoroughly firm, has begun. Then appears the conditions of improperly filled trenches, vexing the engineer in charge of construction and making him throughly disgusted with the manner in which the construction of underground structures is conducted; and well he has a right to be; with sewers in the centre of the street, gas, water and subways on either side, very little of the undisturbed ground can be found. The only remedy is to properly fill all the trenches and make them firm foundation. It is enough to discourage the intention of any railway company from constructing permanent way, in the face of just one difficulty the size of this. It makes men feel as if they were, at their own expense, making good the poor work of municipal authorities, and in some cases this is true.

Back-filling of trenches in a general clause is always provided for in the specifications for underground structure. This clause is supposed to cover the treatment of all classes of soil, but in actual practice, each type of soil requires a different treatment. I do not propose to discuss the manner or methods of trench filling, but I do suggest that railway companies co-operate with city officials in placing in specifications for underground structure, clauses pertaining to the proper filling of trenches. Post the bidding contractors on such work that these clauses are for the purpose of properly filling the trench, and to the successful contractor in obtaining such a contract, by all means see that the conditions of this clause are fully carried out. The question of back-filling has never been given the amount of attention that should have been given it by engineers, the universal belief being that the concrete foundations of pavements will bridge these settlements. How many poor pavements have we in cities, and how many pieces of poor track can be seen from this erroneous practice. Some few railway companies have become so thoroughly discouraged in attempts to obtain firm foundations that they have been to the great expense of placing concrete foundations six inches thick under the ties to support them, thus bridging the various settlements. This method may be practical in some cases where firm foundations are not obtainable, but beyond these extreme cases, its cost removes it beyond practical use. I maintain that trenches can be properly filled, and by the aid of sufficient rolling, a firm sub-grade can be obtained, permitting the use of broken stone ballast, and lessening the cost of concrete foundations by two thirds. Remove all soft and spongy places in the sub-grade; lay tile drains connected to sewers at such points as seem at all springy, and have the line of the sub-grade, after it has been thoroughly rolled, conform in line and section to the finished grade. You may then feel that you have at least striven to obtain solid foundation. Upon the sub-grade should be spread the ballast, and no better quality of ballast can be obtained than stones that have been broken in a crusher, to a size that will pass through a two-inch ring. There should be not less that eight inches of broken stone ballast under the ties after the track has been surfaced and tamped. The broken stones should be evenly spread in the trench to such a depth that having been thoroughly rolled, will be not less than six inches. The rolling should be done by a steam roller weighing not less than 10 tons, and should be continued until the mass of stone shall become thoroughly compact. Upon the broken stone then place the ties. The use of metal ties is bound to come, and with them the exit of the use of wooden ties, but as long as southern ties of standard size of the variety known as the long-leafed yellow pine can be delivered on the cars or wharves of any of our large cities for 50 cents each, the day for the use of steel ties is deferred. I believe thoroughly in the use of metal ties, and that they are the most economical remains only to be proven by the experience gained from their use. We will watch with great interest the results deduced by the experience of the New York Central Railway. As a practical experiment, a short piece of track was constructed by that road on the Hudson River division, near Garrison station, in 1889, using the type of metal tie known as the "Hartford." The results so far have been very satisfactory and the cost of maintenance reduced to a minimum. The use of wooden ties, however, is bound to be common at the present prices for first-class ties, and at these prices no one need buy poor or cheap ties. In drawing specifications for ties, do not place clauses in them which experience has taught you it is impossible to fulfill. Specify the kind or quality you know can be bought in the market and make the size not smaller than the standard size. *i. e.*, 8 feet long, 6 inches deep and 8 inches wide, and by all means see that the ties you buy are the same as the specifications called for. Do not place less than 120 lineal inches of ties in width to a rail length of 30 feet.

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*Read at the New York State Street Railway Convention, Albany, Sept. 17, 1895.

The rails to be used in streets of cities should weigh not less than 85 pounds to the yard, to a section 7 inches deep, and if the section you purchase is 9 inches in depth, it should weigh not less than 95 pounds to the yard. Select a section with a good wide base, not less than 5¾ inches, and have the width of the head not less than 2½ inches. Almost any standard section of the 9-inch rail offered by rolling mills is good. There are differences of opinion as to the quality of the finish of the different sections of rail. Some maintain that the girder rail with the Tram or "L" head is better finished and more easily kept open to traffic than the half grooved girder sections. I can speak from experience that the half grooved girder sections we have received from the Johnson Company are better finished, make smoother riding track, but we have not yet had the opportunity to try them during the Winter, to see if we can succesfully maintain traffic; however, we can name the city of Buffalo, with its magnificent railway system, as an example of successful operation for many winters.

The fish-plates or channel bars should be at least 32 inches in length, and if for the 9-inch rail, should be punched for 12 1-inch bolts. I believe the corrugated plate, manufactured by the Johnson Company, is the best type yet presented, but with any channel bar or plate of the length of 32 inches, bolted tight with 1-inch bolts, and the nuts held in place by nut locks, the joints should not give way sooner than the rail itself. In fact, the question of joints with fish-plates of this size, properly bolted, is transferred to a question of ties and what supports them.

Use combination brace plates; do not use tie rods. There are several types of combination plates manufactured. The Johnson Company make a single brace plate and tongue; the Mark Railway Equipment Company a double brace plate. The use of either of these have many advantages over the tie rods. I would use brace plates on all deep rails, in preference to tie rods, for the following reasons, if no other: Watch your track foreman, or, if your work is done by contract, your contractor laying track. If you are to use tie rods, when the spiking is being done, see if the gauge bars are used, and I will ventnre to say that the chances are that the spiking gang do not try the gauge of the track more often than on every other tie, and some of the time they forget to do that. They trust to the tie rod to spread or pull, whichever the case may need, the track to proper gauge. Now watch the spiking gang wherever the brace-plates are being used, and you will see quite a different use of the gauge bar. At every single tie the spikers, in order to maintain the gauge of the track, must use the gauge rod, for there is nothing to pull or push the rails to gauge after the rails are spiked. As a consequence, you have a track laid with greater care, so far as gauging and spiking are concerned, than you will have with tie rods, and that is very essential to first-class and easy-riding track. Tie rods in a pavement tend to constantly help, by vibration, the disintegration of the pavement, to say nothing of the trouble encountered in paving around them.

In laying tracks in city streets, place the rails on the ties, making the joints alternate, and no matter what the temperature may be, be sure the joints are laid without open spaces between the rail lengths; butt the ends of the rails up tight and, when they are in position, bolt the plates up, driving them home with a hammer. Do not spare the cost of inspection at this point, but be sure that the joint plates are all tight. With properly bolted plates and rail ends tight, you have approached as near a continuous track as is possible without welding the joints, and yet you have given a chance in extreme Winter weather for contraction.

In driving the spikes be sure that the gauge-bars are tried on every tie. Use 5½ x 9 1-16 spikes, four on every tie. When the rails are thoroughly spiked and bolted, the track is ready for surfacing and tamping. Great care should be taken to properly tamp each tie firmly. Ties tamped with broken stone ballast do not sound as firm as ties tamped with gravel ballast, but broken stone will stay in place, while gravel ballast will wash down. Tamping with broken stones costs more, but firmer track is the result. The track now is ready to receive its final alignment, and with great pains and care see that all irregularities in line are taken out. Unless block stone pavement is to be laid, fill to the top of the ties with broken stone, made thoroughly compact by the use of rammers, and you can rest assured that, with a space of nine inches from the top of the ties to the surface of the pavement, in which space can be laid the pavement and its foundation, that there will be no objections from the municipal authorities of poor foundations. Once more try the bolts and fish-plates to see that all are tight, and then place on the bolts the nut locks to keep them tight. Your track is now ready for bonding. Use the type of bonds that will give the greatest contact with the rail connected by a single No. 0000 wire. The use of single bonds of a larger size saves labor when compared with the use of double bonding with bonds of a smaller size. After your track has been thoroughly bonded you can now turn the tracks over to the paving company.

Car Heating by Electricity.[*]

BY J. F. MC ELROY.

The general principle employed in the construction of electric heaters is that of placing in these heaters suitable resistances, which resistances become heated by the passage of the electric current. In the Burton heater, one of the earliest electric heaters tested on the electric railways in this country, a resistance wire made of German silver was bent in a zigzag form and placed within the hollow space between two iron castings. The wire was embedded in powdered fire clay, and the castings bolted together so as to prevent the loss of fire clay and the disarrangement of the resisting conductor. These two castings, which together formed the casing or outside of the heater, contained a roughened surface for the purpose of enlarging the radiating surface of the heater itself. It was claimed that the embedding of the resisting conductor within a powdered mass of fire clay prevented the air from reaching the conductor, and hence prevented its destruction by oxidation when exposed at high temperatures of air.

J. F. McElroy.

Oxidation in a resisting conductor may be retarded if it is possible to keep the oxygen of the air from reaching the surface of the conductor, but it must be apparent that by such a construction results may be reached which are just as objectionable as the oxidizing of a conductor by contact with air. It is evident that the embedding of a resisting conductor in powdered fire clay, or other powdered or pulverulent material which, from its very nature, would be classed as a non-conductor, would retard the escape of heat. The objectionable result is then reached that the temperature of a conductor rises to such a degree that the life of the conducting material is soon destroyed.

Other electric heaters were put upon the market, but much difficulty was experienced either from the oxidation of the resisting conductor, or from its destruction by fusion when enclosed in a mass of material such as is shown in the Burton heaters.

In considering the conditions which exist in electric heaters, and which led to the early destruction of the resisting conductors, we are brought to see that after all the question of building an indestructible heater is comparatively a simple one. In the first place high temperature is one of the conditions which lead to the destruction of the resisting conductor. This difficulty arises from the fact that oxygen of the air will attack metals more strongly when a high temperature is maintained in the metals. For example, if, instead of running an iron wire at a temperature of perhaps 400 degrees, which temperature may be reached with steam in an iron pipe, let us run the wire at a temperature of 900 or 1,000 degrees Fahrenheit. We soon find that the wire when run at the high temperature becomes oxidized over its surface, and in a short time changes its resistance and finally breaks or separates. This difficulty does not occur at the low temperature of 300 or 400 degrees, but always does occur when metals are run at a temperature of from 900 to 1,200 degrees Fahrenheit.

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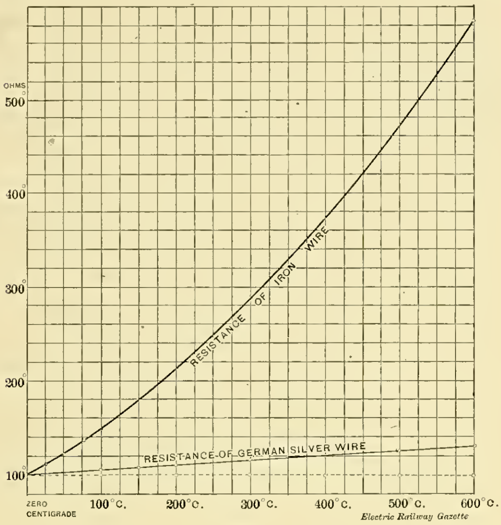
[*] Abstract of a paper read before the Convention of the New York State Street Railway Association, Sept. 17, 1895.

Another cause of the destruction of resisting conductors lies in their crystallization at high temperature. This is a difficulty to which German silver or any alloy of different metals is especially liable. For example, German silver is composed of copper, nickel and zinc in equal parts, the zinc having a melting point of 680 degrees Fahrenheit. If, now, this metal is used in electric heaters and its temperature is run above the melting point of zinc, it will be found that crystallization of zinc in the conductor takes place, and in a short time the wire separates and the heater becomes useless. Crystallization of zinc often occurs from jarring or vibrating a wire at a much lower temperature.



Electric Railway Gazette

FIG. 1.

It is not necessary, in the construction of electric heaters, to run near to either danger points just mentioned—that of high temperature or the danger from the use of German silver or other alloys. It is apparent that the temperature above air of the resisting conductor depends upon the amount of heat which that conductor gives out per square foot of its surface, and that the total amount of heat would, therefore, depend upon the number of such units of surface which there may be in the conductor. The reduction of temperature in the resisting conductor may be carried to any extent desired by simply increasing the amount of actual surface in the resisting conductor, its temperature thus being reduced to a point where the conductor is absolutely safe and its life is permanent.

In the construction of the heaters made by the Consolidated Car Heating Company, of Albany, cylindrical porcelain tubes are threaded upon a five-eighth-inch square iron rod. These tubes are provided on their surface with a spiral groove which runs continuously from end to end. A porcelain disc is placed at each end of the heater, and when desired one is placed at the centre for the purpose of furnishing supports for the binding screws to which the ends of the resisting conductors are attached. No. 20 B. & S. galvanized iron wire is coiled in the form of a close and continuous helix. As this wire is wound by a machine in the form of a continuous coil, just so much of the wire is separated in forming a coil as gives us just the proper resistance. These coils are then placed in the groove which runs spirally around the porcelain insulators. Care is taken to stretch out the coil sufficiently to prevent adjacent spirals of the coil from coming in contact with each other, and contact with that part of the coil in neighboring grooves is prevented by ridges separating the grooves on the porcelain. The result is that the wire is thoroughly insulated, and short-circuiting within the heater itself is prevented, and still it is wound open so as to present its whole surface to the air. It is so arranged, too, by its even pressure upon the porcelain insulator that no part of this coil can vibrate, and hence there is no danger from the crystallization of the iron wire while hot from tremor or vibration of the heated wire. This feature of this heater is a very important one, as it absolutely prevents the crystallization and, hence, breaking of the resisting conductor. These coils have now been operated for over three years and not one coil has given out or has shown any oxidizing effect in the substance of the wire. The use of iron as a resisting conductor obviates the difficulties of crystallization to which German silver is especially liable. The melting point of iron is at a temperature of nearly 3,000 degrees F., so that the temperature of fusion is so far above the normal temperature of the resisting conductor, and as vibration of the conductor is prevented by the method of winding it on the insulator, no danger occurs from oxidation, fusion or crystallization.

It is important in the construction of electric heating devices that the expansion of the metallic wire due to change of temperature be fully provided for, and that the heater be so arranged that under no circumstances can the force of expansion and contraction create a strain upon the resisting conductor or upon the insulating parts which would be liable to injure or to break them. This is especially important in conductors designed to be run at a high temperature as the difference in length of the conductors at the extremes of temperature to which it is subjected is quite a considerable part of its length.

It is a well-known principle that a wire of a given length if heated and then cooled, and again heated and cooled, is not the same length at the same temperature that it was in the first test. Changes will go on for some time in lengths of wires so subjected to heating and to cooling, and this fact should be considered in the construction of electric heaters.

On the other hand, care must be taken that under no conditions can the expansion of the wire make it loose on the insulator and so cause a short circuit between neighboring wires. In a car equipment of the heaters just described the length of wire, when heated to the highest temperature to which it is subjected in the regular operation of the heater, is 7 feet 5 inches longer than it is when cold. By the construction adopted it is apparent that this expansion is taken up between consecutive layers of the wire itself, so that expansion and contraction of the wires do not operate to vary the tension of the coil of wire, nor even to vary the pressure with which it binds the insulator itself.

The change of temperature in resisting conductors is attended with other phenomena which should be considered in the construction of electric heaters. For example, it is well known that the resistance of a wire of a given material of given length and cross-section depends upon the temperature at which the resistance is measured. Iron wire possesses certain qualities in its variation of resistance with temperature which admirably fits it for use in electric heaters. In Fig. 1 the upper curve shows the change of resistance in a coil of iron wire having a resistance of 100 ohms due to the different temperatures of iron, as indicated on the horizontal line. From this it will be seen that an iron wire having a resistance at zero Centigrade of 100 ohms has its resistance doubled when the temperature is increased to 180 degrees Centigrade, and that its resistance is increased to 500 ohms when its temperature is 525 degrees Centigrade. The expansion of German silver is shown in the lower curve of the same diagram. It will be here seen that change of resistance in German silver is but a mere friction of the change of resistance of iron wire.

The application of this variable resistance in the construction of an electric heater is the automatic control which this property of iron wire gives over the temperature of the electric heater itself. If a non-conducting hood is placed over an electric heater which prevents the circulation of air, the escape of heat will be prevented and the temperature raised to a dangerous extent.

The use of the variable resistance, so marked in iron wire, is apparent, as its effect is to reduce the amount of current flowing through the heater, and hence to reduce the amount of heat generated. By referring to Fig. 1 it will be seen that the two electric heaters, one of iron wire and the other of German silver, both having the same resistance at zero Centigrade, and both being covered with a non-conducting hood, which prevents the escape of heat, would, as the temperature rises, act very differently. For example, if the temperature rises to 300 degrees Centigrade only two fifths as much current would pass through the iron resisting wire as passes through the German silver. This throttling action of the iron wire increases more rapidly even than the increase of tem-

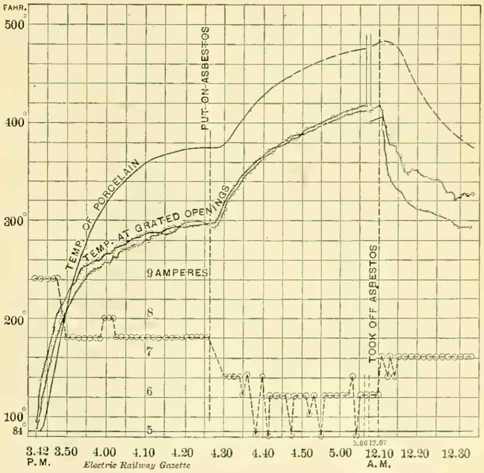


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FIG. 2.

perature, so that at 600 degrees about one fifth as much current passes through the iron wire as passes through the German silver, and in each case the reduction in current means also a reduction in the amount of heat generated. A heater, therefore, provided with an iron resisting conductor has this peculiarity over that equipped with German silver, that if for any reason the escape of heat from an electric heater is prevented, either purposely or accidentally, the action of the rise of temperature upon the heater itself is to so throttle down the amount of current passing through it, and hence the amount of heat generated, as to prevent such a high temperature of heat that might prove dangerous. This throttling action of the electric heaters with iron resisting conductors is illustrated in Fig. 2. The upper curve is a curve of temperature obtained from a thermometer placed within the porcelain insulator itself. The two lower curves of temperature were obtained by two thermometers placed within the heater casings and about one half an inch above the coils of the heater proper. An idea of the rise of the temperature of the air in the upper part of the heater casing may be obtained from these curves. The time is laid out on the horizontal lines, the vertical lines being lines of temperature. After the heater had been in operation until the temperature within the porcelain and the temperature within the heater casing, as indicated by the two lower lines, had become practically constant, the discharge openings of the heater were covered with a close-fitting sheet of asbestos, which would prevent the escape of heated air. The effect upon the temperature within the heater casing is at once apparent, and the upward movement of the curve indicated the rate and amount of that rise in temperature. The throttling action is illustrated in the fourth curve, which represents the amount of current passing through the heaters and also represents the amount of heat generated. When the current is first closed through the heater it will be seen that a large flow of current takes place until the heater itself becomes heated up, when the amount of current is automatically throttled down. The curve then remains nearly horizontal, indicating a nearly steady flow of electricity until it reaches the point where the discharge opening of the heater was closed, when the current drops, the amount of this drop indicating the amount of the throttling action of the conductor itself. At the point indicated in these curves the asbestos damper was removed from the discharge of the heater, and the curves then indicate the fall in the temperature of the space above the heater, while the curve showing the amperes rises in a very short time to its normal height, indicating that when the heat is free to discharge from the heater more heat is generated. This action will take place in any heater in a car and will take place in one heater independent of other heaters.

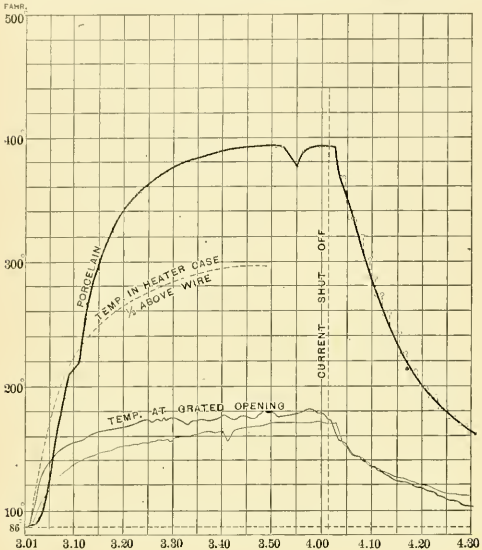

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FIG. 3.

Fig. 3 has been made from tests in which the temperature at the grated openings has been taken very carefully with thermometers placed against the grated openings but not within the heater case. This would indicate the temperature in front of the heater openings and at points where the clothing of the passengers might possibly touch, and shows that the highest temperature in the air that is reached is about 180 degrees F., due to the free discharge of air up through the heater by which the heat as fast as it is generated is carried into the car. Another curve shows the temperature recorded by thermometers placed within the heater case and within one half inch above the wire coils. The upper curve indicates the curve of temperature of the porcelain itself and is obtained from the readings of the thermometer placed within the hollow openings of the porcelain. It is seen that the temperature of the porcelain rises rapidly and the temperature also descends rapidly when the circuit is open.

The proportion of electric energy transformed into heat in a conductor depends upon the resistance of the conductor. The electric heater is the only case that comes within our knowledge where 100 units of electric energy may be transformed into 100 units of any other one form of force. We can then establish the heat equivalent of the electric current for all electric heaters in which no disintegration takes place in the resisting conductors, one British thermal unit (one pound degree F.) being produced by 1,047 watts of electric energy. We are constantly meeting with business men, as well as so-called inventors of electric heaters, who claim that some particular form of electric heater which they have devised will produce a greater amount of heat per unit of electric energy than some other form of heater. This is plainly impossible so long as neither mechanical motion, chemical motion, light nor magnetism are produced in the electric heater. Transmission of electric energy is therefore entirely into heat with an efficiency of 100 per cent. It is true that in some of the forms of electric heaters a chemical action, resulting in the destruction of the heater, is produced by the electric current. Where chemical action takes place the chemical action can be determined in units of energy; the efficiency, then, of that particular electric heater must be 100 per cent. minus the amount so transformed into chemical action. But, where we have the wires of electric heaters running year after year without any change of any kind appearing in these wires, it is evident that the efficiency may be regarded as 100 per cent.

It is an easy matter to determine the exact amount of heat which is produced in electric heaters when the consumption of current is known. For example, if we find the number of watts by multiplying the number of amperes passing through the heater by the difference of voltage of the heater terminals, and then divide the number of watts by 1,047, we will have a quotient the number of British thermal units of heat generated in the electric heater per second. If we consider the electric heaters in a car to be using as a maximum 12 amperes of current on a 500-volt circuit, we will find that 12 amperes of current multiplied by 500 will give us 6,000 watts. Dividing 6,000 watts by 1,047 we obtain 5.73 British thermal units of heat generated in the car per second. Multiplying 5.73 British thermal units by 60 will give us 343.8 British thermal units per minute.

Practical experience in the heating of cars has demonstrated that it requires about 20,000 British thermal units per hour to properly heat an 18-foot car in the latitude of New York State in the coldest weather, which amount of heat should be provided as a maximum. The average requirement during the months of the Winter when heat is used would not exceed one half of this amount, or would be, approximately, 10,000 British thermal units per hour. See Fig. 4.

The amount of heat required, however, differs somewhat according to the construction of cars, to their exposure to winds on the lines where they are run and to the care exercised by conductors in closing the doors promptly when passengers enter or leave the cars. All of these are points which effect materially the temperature which will be maintained in a car with a fixed amount of heat. Also the number of people in a car effects quite perceptibly the amount of heat required. Crowded cars require less heat to maintain a given temperature than is the case with cars carrying but few passengers, due to the amount of heat given off from the bodies of passengers. Experiments have been made as to the effect of passengers upon the temperatures of cars and houses. It has been found that each person gives out 191 British thermal units of heat per hour. When we compare this amount with the average amount of heat required during the cold weather, we find that the heat given out by 52 persons will maintain the same temperature in the car as it is required on the average during the Winter months. This

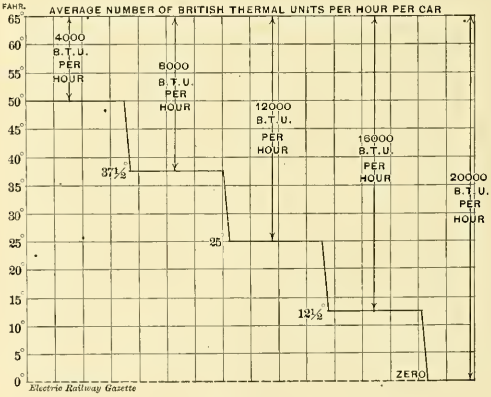

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FIG. 4.

point has a practical bearing in the heating of cars in that, if a car is heated uniformly as with a stove, it would be found over-heated during those hours of the day when the cars are filled with passengers. When electric heaters are used some roads have established the practice of reducing the heat between certain hours when their cars are filled with passengers. This would still allow a comfortable degree of heat to be maintained in cars, at the same time would allow the use of the extra power for propelling cars at the time when travel is the heaviest. The next point in regard to electric heating is the regulation of temperature. As the temperature of the outside air during the heating season will vary from 50 degrees to 15 below zero, it is important that the electric heating apparatus be so constructed that the amount of heat given to the car varies so as to meet the demands of the variable weather. This is necessary for two reasons. First, it is necessary in order to maintain a comfortable temperature in the cars with variable conditions in the weather, and second, it is important in order that the consumption of current shall be adjusted to the actual demands. Undoubtedly a great saving in the use of current is brought about by the use of apparatus that is provided with means for proper regulation.

A device introduced for the purpose of regulating the temperature of cars, and by which five different intensities of heat may be obtained, corresponding to consumptions of current varying from two and one quarter to twelve amperes, operates by shifting the heating coils constituting the car equipment, into series and multiple series, so as to vary their combined resistance and hence to vary the flow of current through them. On small cars and in climates where comparatively a small amount of heat is required, an equipment consisting of four heaters is often used instead of six, as in the standard equipment. These four heaters are connected up with a three-point switch which is so arranged as to place the heating coils in multiple series so as to vary the consumption of current from two and three quarter up to eight amperes.

TABLE SHOWING FUEL AND OTHER COSTS OF ELECTRIC CURRENT ON A 500-VOLT CIRCUIT, AND THE FUEL COST OF OPERATING AN ELECTRIC HEATER IN FIVE DIFFERENT POSITIONS OF TEMPERATURE REGULATING SWITCH.

TYPE OF ENGINE.	I. hp to produce 500 net hp on high-speed engine shaft, or jack shaft of low-speed engine.	Gauge steam pressure.	Pounds of coal per I. hp per hour.	Total cost in cents of one ampere-hour on 500-volt circuit delivered at the car, including operating expenses and coal, supplies, repairs, wages, insurance, taxes, renewals and 8 per cent interest on the investment.	Cost of coal per hour in cents for heating a car with Consolidated Car-Heating Company's equipment of six electric heaters on a 500-volt circuit, when switch is placed in different positions, as follows:				
					Intensity **1** Uses 2.14 Amperes.	Intensity **2** Uses 2.88 Amperes.	Intensity **3** Uses 6.98 Amperes.	Intensity **4** Uses 8.09 Amperes.	Intensity **5** Uses 12.05 Amperes.
				Coal at $2.00 per 2240 lbs.	Coal at $2.00 per 2240 lbs.	Coal at $2.00 per 2240 lbs.	Coal at $2.00 per 2240 lbs.	Coal at $2.00 per 2240 lbs.	Coal at $2.00 per 2240 lbs.
Simple high-speed non-condensing	542	100–120	3.882	.84	.64	.86	2.01	2.43	3 62
Simple low-speed non-condensing	556	100–120	3.412	.78	.57	.78	1.89	2.19	3.26
Compound high-speed non-condensing	542	100–120	3.059	.74	.50	.68	1.64	1.91	2.85
Special triple-compound high-speed non-condensing	542	150–170	2.824	.72	.47	.63	1.52	1.77	2.63
Simple high-speed condensing	542	100–120	2.588	.68	.43	.58	1.40	1.62	2.41
Simple low-speed condensing	556	100–120	2.353	.64	.40	.54	1.30	1.51	2.24
Compound high-speed condensing	542	100–120	2.353	.66	.39	.52	1.27	1.47	2.20
Compound low-speed condensing	556	110–125	2.118	.62	.36	.48	1.17	1.36	2.03
Special triple-compound high-speed condensing	542	150–170	2.000	.62	.33	.44	1.08	1.25	1.86
Triple-compound low-speed condensing	556	150–170	1.882	.60	.32	.43	1.04	1.21	1.80
Triple-compound low-speed condensing	556	160–170	1.765	.59	.30	.40	.98	1.13	1.69
Ditto for probable maximum results	556	160–170	1.474	.59	.25	.33	.81	.94	1.40

NOTE.—The heater is usually operated at intensity 3, which meets the requirements of outside temperatures between 20 degrees and 30 degrees F.

As to the cost of heating cars by electricity, it is evident that the cost is determined by the cost and quantity of current consumed. If the number of ampere-hours on a 500-volt circuit can be once determined and the cost of an ampere-hour on the same circuit is known, the cost of running electric heaters can be readily ascertained. The question of cost, however, is not easily determined, as it still remains an open question as to just what items should be charged to electric heating. It would be but fair for a company considering the advisability of introducing electric heaters in their cars, to consider, not the total proportionate cost of current consumed, but rather the additional cost of generating the current to supply the electric heaters, not charging to electric heaters such power-house expenses as would continue the same provided electric heaters were not introduced, but only the cost of the additional current. These costs have been carefully determined, based upon the cost of producing power by different types of engines as contained in a paper by Dr. Charles E. Emery, in the transactions of the American Institute of Electric Engineers for March, 1893. The costs are based upon units of 500 hp, and so far as the figures by Mr. Emery are concerned, give the cost of horsepower in the engine wheel or jack shaft. Efficiencies here are allowed of 90 per cent. in the generators and 93 per cent. in the distributing system, making a combined efficiency of generators and lines of about 82 per cent. Corrections can be made upon the figures contained in the table to fit any given case, as it is found that the efficiency of the lines may be greater or less than 93 per cent.

It will be seen from the above table that the cost of operating electric heaters will depend upon the kind of engine employed and the cost of coal. For example, if coal costs $2 a ton of 2,000 pounds, and if the average consumption of current in cold weather is seven amperes, and if we take a compound low-speed condensing engine as the average type of engine in point of economy in consumption of fuel, we will find that seven amperes for one hour will cost 1.17 cents.

From the reports received the average length of time a car is in service per day in the Winter time is shown to be 15 hours. The cost of operating electric heaters with the average consumption of current in cold weather would, therefore, be 15 times 1.17 cents, which equals 17.55 cents for 15 hours. This cost does not allow for any depreciation in heaters, as the three years of service of the heaters here considered does not appear to have any effect upon the life of the conductors, and not a single coil in any heater has ever been renewed in this length of time. So far as examinations of the coils that have seen three years of service can determine, absolutely no oxidation has been produced upon the wires. Some allowance, however, should be made for repairs, when the amount of necessary repairs can be ascertained.

As to the cost of heating by stoves, a number of reports have been received from different railways in New York State using stoves. The list of questions submitted was designed to bring out as full information as possible in regard to the operation of cars equipped with these stoves. Several roads furnished reports, and where quantities are mentioned the figures given above are the average of the quantities stated in these reports.

Taking the average made in the answers referred to, it was found that

33 pounds of coal were used per car per day, costing $4.55 per ton of 2,000 pounds. This coal costs 7½ cents per day. The average cost of repairs per car is ½ cent per day. The average cost of dumping fires, removing coal and ashes before car is run out of barn, and coaling up and kindling fire in the morning, including the cost of kindling used and that part of cleaning cars chargeable to stoves, is 10 cents per day. The average cost per day of other expenses chargeable to stoves not included in above, such as cost of removing stoves for the Summer, installing of the stove in the Fall, repairing of head linings, repainting, etc., averages 1¼ cents per day. Without adding anything to the cost of the stove for the space for one person occupied by the stove, the total of the items so far aggregate 19¼ cents per car per day. It has already been stated that the extra cost of current based upon the cost of power necessary to heat a car with seven amperes of current on a 500-volt circuit aggregates 17.55 cents per car per day. This amount will be modified as different types of engines are used; for the type of engine generally used it is correct. Other questions of greater importance enter, however, than the cost of the mere heating by electricity or stoves, such as the effect which electric heating has in inducing travel upon street car lines. It is, however, a difficult thing to determine in figures exactly what increase of travel takes place, on account of having cars properly heated at all times, and that heat being properly distributed through the car. This point is worthy of the consideration of managers of street railways in the matter of securing patronage for their lines.

The following is a summary of answers sent to the Consolidated Car Heating Company, in reply to a series of questions regarding heating: Make of coal stove, Standard, Lewis & Fowler, Columbia. Fire first started in stoves Nov. 15; fire discontinued March 24. Average amount of coal consumed per stove per day between dates mentioned, 26 to 38 pounds; average, 33 pounds. Average cost of coal per ton, $4.25 to $5; average, $4.55. Number of hours fire is maintained per day, 17 to 24. First cost of installing stove, including smoke pipe, smoke jack, etc., $22 to $25; average, $23. Average cost of repairs per car per year to maintain stove in working order, 17 cents to $1; average, 59 cents. It was stated in regard to the average cost per day of dumping fire, removing coal and ashes therefrom, before car is run out of barn, coaling up and kindling fire in the morning, including cost of kindling used and that part of cleaning cars due to stoves (in some cases the work was done by watchman without extra cost, and in other cases it was 20 cents per day); other expenses per day not chargeable in the above, as removing stove in Summer, installing in Winter, repairing head linings, repainting, etc., were said to be not over $3 per year per car. Seating space occupied by car was said to range from that required by one person to 19 inches. No objections were found by persons sitting next to stove. The replies to the question whether the heat was evenly distributed were: "Warmer in the center," "Fairly" and "Very little complaint." In answer to the question whether, if the stove occupied space of two persons this seating capacity should be charged to the stove, two companies answered "No," and another replied, "Space of one person should be charged." The question whether dresses had been burned was answered in the negative. Three companies answered in the negative the question whether head linings and other part of car had been renewed on account of damage from the stove.

Signals on Electric Railways.*

BY J. H. BARNARD.

With the advent of mechanical power in the field of street railway operation came a consequent change in management and service. Within a short time we learned so positively the value of large, handsome, clean cars and good service, that to-day an ill-kept, untidy car is no longer the rule, but the great exception. The higher speed of the mechanically moved car decreased the headway, but instead of that lessening the number of cars required, the improved service so stimulated travel as to demand even a greater number than before. But, while the acme of clean, neat cars can easily be reached and maintained by all who pay for their care, the acme of good service is—like perfection—never reached. Even a high character of service requires the unceasing efforts of all the executive force in maintaining a discipline adequte to meet with precision the most unexpected emergency; but, in spite of the high success in this direction, the lack of ability to promptly report troubles and to transmit instructions not only unduly tests the best organization, but robs it of much of its possible value. Railways can afford telegraph operators at frequent intervals, as where their duties as operators are insufficient to warrant their salaries they can fill various other duties, whereas this is not true of street railways. Signals, electric or mechanical, are too limited in their range, consequently the telephone is the instrument which can best replace the telegraph line in the hands of our class of employees. Over a two-wire telephone line any conductor or motorman can report in detail a trouble from any of as many stations as you desire to install, and prompt measures be dictated by the highest executive, if necessary.

This fills the want as far as communicating from an outlying point to the office where there is always some one to notice the call bell; but, unless a separate wire be running from each station to the office, and that at a very considerable expense, there has not been, heretofore, as far as I know, a means of setting a permanent signal at a desired point to arrest the attention of the next employee that may pass. This ability, however, even on a double-track road, is a very important one. A trolley wire has broken, and you want your lineman from some distant point with the least delay; a car is derailed, and unless you have a regular wrecking crew, you want your trackmen with their jacks, linemen with their tackles, or both, and you want them as quickly as possible.

But however badly this ability is needed on a double-track line, it does not compare with its necessity on a single-track line. Your cars, from one cause or another—you that handle single-track lines know how various are the causes and how frequently they can present themselves—get out of schedule, "out of phase," you may call it, and no man living can get them back into phase by the easy methods that are usually apparent, because of your inability to give to distant crews orders complementary to those you would give to those near by. Consequently, the requirements of a single-track road are, that from any station, wherever you may be, you must have the ability to call and instruct the men at such points as the particular need demands without calling and so detaining the men at other points.

If this be rendered possible, you have gained yet another important power. If a station be located at each turnout, a man at any one of them can set a signal or communicate with another at the next turnout, and herein lies the greatest and only means of reducing to a minimum loss of phase—because in 99 out of 100 cases, you may say always that general disarrangement begins in localized disarrangements. A car has an unusual number of stops to make, blows a fuse in starting on a grade, is blocked for a few minutes by a wagon across the track unloading, by a thousand and one insignificant things, consequently is late in reaching the next passing point. The car due to pass it there waits, how long? Well, it waits. Probably all its passengers are in high dudgeon, criticise the management and vow (and to a certain extent keep their vows) not to patronize such a line in the future. This is all bad enough, but this is only the beginning of the trouble. Each one of these cars is due to meet another car at its next turnout ahead; consequently, a few minutes later two cars are awaiting two delayed cars, and again, a little later at the second turnout ahead, two more cars are waiting, and so it multiplies. If travel at the time be light, your cars may be able to pick up again their lost time, but usually a serious disarrangement occurs from the frequent stops of more than an individual car due to heavy travel. Then when it is of every importance that your cars should move like clockwork to earn every possible nickel, as well as to maintain your reputation, your cars are utterly at a loss. Through ignorance of the opposing car's position they will lose valuable time at a turnout, when, had they only known it, they might have proceeded to the next; or, after waiting a due length of time they proceed only to meet the other car between turnouts, and one has to run back.

It is not that a single-track road is, as many assert, not worth building. Many a route will support comfortably the investment required for a single track, which would not pay the interest on the bonded debt of a double construction. Indeed, with the means of instructing the car crews when to wait and when not to wait, I assert that under ordinarily good management, a single-track road may handle smoothly an amount of travel that few will think possible. With such means at your command, or the command of your men, the loss of a schedule by one car can be easily kept to nothing worse. If you have extra turnouts to allow the employment on days of heavy travel of a larger number of cars than ordinarily, you may, in the case of a sudden increase, put out some extra cars to meet it, as one would do on a double-track road without previous warning to the men beyond the reach of your voice, and that without delaying their cars. Should travel not develop as prepared for, you may, at pleasure, withdraw your cars as they arrive, without the remainder waiting at turnouts for cars that would never come.

Nor to do this do you require, except where the road can afford it, anyone in the nature of a train dispatcher. If a car is late at a turnout, its crew does one of two things. If it is so much behind its schedule that the rule forbids its proceeding, one of them drops the signal at the next turnout where it is due to meet a car, and when one of the crew of that car answers at the telephone, he is told to come on, thereby limiting any loss of time to only that car which is already out of phase. As for itself, it simply falls back upon the schedule of the car following it, and on this car's right of way precedes it to the last turnout, where, transferring to the car behind any passengers it may still have, it turns back on its own schedule. Such a course entails a slight further delay to the passengers on that car alone, but none to any of the others.

If it is behind its time less than the limit established in the rules, it continues its way, first dropping the signal at the next turnout. Should it fail to reach that turnout on time, the opposing car will have waited for it, because when one of its crew went to the telephone he was not answered, showing that it must have been set to hold his car, presumably by the crew of the car due to meet him there.

This much toward keeping the cars informed of each other's movements is an immense assistance, and to this extent an ordinary signal system, automatic or otherwise, is a great aid, but here a signal system has reached the limit of its possibilities; and still there is another common and most prolific source of general disarrangement, and that is where both of two approaching cars are that late the rules forbid their proceeding, consequently one lies at No. 6 turnout and the other at No. 8, when each might proceed to No. 7, without delaying any car and possibly finding themselves able to make up enough time not to delay other cars at 5 and 9, thus ending the trouble at its source. In this case the crew at No. 6 would have set No. 7 signal, as would also the crew at No. 8. Any one near the office instrument (an extension to the engine room can be cut in when at any time the office may be vacated, so that the engineer may hear calls) noticing the repetition would understand the situation, and calling up both cars tell them to proceed.

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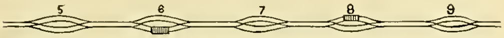
*Read at the convention of the New York State Street Railway Association, Albany, Sept. 17, 1895.



Then, too, after every precaution has been taken to prevent general disarrangement, should one occur, and in spite of all it will occasionally, with the means of talking from whatever station you may be at to such crews as you desire, loss of phase loses much of its sting, and trouble much of its victory.

Accumulator Traction.

Now that storage battery is to be introduced on the Fourth Avenue line in New York it is interesting to note the grounds on which the installing company bases its expectations of success. There has never been any doubt as to the advantages possessed by a storage battery system of electric traction, the only doubt ever expressed being one concerned solely with the question of operating expenses. In a recent article on this subject Maurice Barnett states that the Electric Storage Battery Company, of Philadelphia, which will introduce the system, claims to base its estimates as to the capability of its cells upon actual knowledge of the daily performance of the "Chloride" accumulator in traction work in France, where a type of battery similar to that to be employed in New York has given entirely satisfactory results.

In considering the approximate cost of traction by storage battery cars, continues Mr. Barnett, the point of chief interest is the factor of maintenance and handling. This, according to the report of J. Sarcia, in the *Bulletin de la Société International des Electriciens*, was 3⅓ cents per car mile—a figure, however, susceptible of marked reduction. In order to explain this and at the same time to show that the above figure was based upon conditions not wholly favorable to storage battery traction, it may be interesting to give a synopsis of Mr. Sarcia's report, descriptive of the industrial application of accumulators to electric traction made by the Tramway of Paris and the Department of the Seine on the line from St. Denis to Paris and from St. Denis to Neuilly.

The lines in question, which are known as (1) Saint Denis-Madeline, (2) Saint Denis-Opera, and (3) Saint Denis-Neuilly, have their termini near the depot of Saint Denis. On these lines electric traction superseded horse traction June 1, 1892, and up to the present time about 2,000,000 car-miles have been covered by the storage battery cars. The grades are fairly severe, being as high as 4 per cent. for considerable distances and ranging frequently from 2 to 2½ per cent. On the Madeline line each car covers daily from 88.8 to 97.5 miles. The conditions on the Opera line differ in that the motor car tows an ordinary car carrying 50 persons, making 100 persons in all hauled by each motor car. On the Neuilly line each car makes two trips out and back on the Opera and Madeline lines, or about 30 miles on a single charge of the battery. On good Vignole rails, where the traction coefficient was only 13.2 pounds to the ton, the distance covered on each charge of battery was no less than 70 miles. Mr. Sarcia further points out that in order to replace a discharge battery by a fresh one it was necessary to handle 24 trucks, involving a large expenditure of labor. The necessity for this grew out of the circumstance that the company, instead of building a modern power-house with every convenience for reducing the handling of the batteries, rehabilitated the old horse-car stable and converted it into a charging room. Moreover, instead of supporting the battery under the car, it was placed in the sides of cars underneath the seats. Mr. Sarcia estimates that in the style of car to be used in New York a saving of $\frac{6}{10}$ cent per car-mile could be effected in handling. Subtracting this from 3⅓ cents given as a result actually obtained in practice, we have 2.7 cents as cost per car-mile for maintenance and handling of battery.

The cost of power will obviously depend on price of coal at power-house, cost of labor, oil, waste, water and other supplies. Mr. T. S. Badger gives the average cost of power as 1.96 cents per car-mile, for 22 trolley roads with from three to 140 cars in operation; length of track, three to 51 miles; daily mileage, 80 to 150; average daily mileage, 110. Now, as in the storage battery system, engines and dynamos are run at a constant load it is safe to assume that cost of power, neglecting interest and depreciation, will not exceed 80 per cent. of the figure given, or 1.56 cents per car-mile. Authorities are not wanting who ascribe to the storage battery system an even greater efficiency. In Dubuque, Iowa, with a comparatively small number of storage battery cars in operation, the cost for power was only 1.8 cents per car-mile—bearing out the belief that 1.56 cents is not too low for well-designed power-houses operating a fair number of storage battery cars.

As already stated, owing to the low pressure used in the storage battery system, the durability of the motors is very greatly increased. The average maintenance cost of the rolling stock of the 22 trolley roads cited is 1.8 cents per car-mile. Mr. Sarcia puts this factor at one cent per car-mile. In New York, where every effort will be made to introduce the very best electrical equipment, and carry on the work under the most favorable conditions, it is safe to say that the true figure for maintenance of rolling stock will not be more than .8 cent per car-mile.

Regarding maintenance of power plant, it may be said that inasmuch as the power plant in a storage battery system need only two thirds as large as that in a trolley system, the maintenence cost will be only two thirds as large. As a matter of fact, it will probably be only one third as large, since the machinery is free from the strains to which it is subject in the direct supply system. There being, furthermore, no external circuits, lightning is less apt to play havoc with the electrical part of the equipment.

Coming down to the question of interest on total investment, consider first the investment per mile of track length of the trolley system. Trolley construction, where iron poles are used and where, as in cities, the speed wires must be buried, will cost about $12,000 per mile of single track. As 16 to 20-foot cars can be had fully equipped for say $3,250 each, two cars (to the mile) will cost $6,500. Making an allowance of 15 hp per car at $100 per hp, for power plant, excluding real estate or buildings, we have for the two cars $3,000. Cost of roadbed will add about $7,500 per mile of track, while real estate, buildings, etc., may be assumed to be $7,000 per mile of track—making a total investment of $36,000 per track-mile. On the basis of 56,000 car-miles run per annum per mile of track length, we have, at 6 per cent. per annum, an interest charge of 3.85 cents per car-mile to be added to operating expenses. For storage battery construction there is an item approximating $7,600 for batteries for the two cars not found in trolley construction. On the other hand, a saving is effected of $12,000 for overhead construction, while the cost for power equipment and real estate is reduced by one third, being $2,000 for the former and $4,666 for the real estate, buildings, etc. We thus have a total cost of construction of $28,267, or say $28,000, and with the same trackage as in the case already considered, we have an interest charge, per car-mile, of 2.99 cents.

Assuming that in the two cases just considered maintenance of roadbed and track, transportation and general expenses will remain the same, we can arrange in parallel the values already given. A general distribution of expenses per car-mile is, then, as follows:

	Trolley. Cents.	Storage Battery. Cents.
Maintenance of roadbed and track	.54	.54
Maintenance of line	.18	..
Maintenance of power plant	.36	.12
Maintenance of rolling stock	1.80	.80
Maintenance and handling of batteries	..	2.70
Cost of power	1.96	1.56
Transportation expenses	4.98	4.98
General expenses	1.26	1.26
Interest on total investment	3.85	2.99
Total	14.93	14.95

As given here the cost of operating cars by the trolley and storage battery systems, respectively, on roads of 15 miles and upward, with 20 or more cars averaging about a hundred miles daily, with moderate grades—general conditions covering cost of fuel and supplies, wages, etc., being identical—shows both systems to be on an equal footing. Conditions slightly in favor of storage battery construction would, of course, show greater economy for the accumulator system. Thus, if the length of track was great in proportion to number of cars run, the extra interest on the higher relative cost of line construction would swell the operating expenses of the trolley system. Or, again, since fuel is the largest factor in the cost of power, localities where fuel is high priced would change the totals and make battery traction more economical.

In conclusion, it may be said that even if trolley traction were more economical than storage battery traction, the system would be open to the objections that the (1) cars are dependent at all times on the power-house, and have no auto-mobile character as have battery cars; (2) the moment the trolley leaves the line the cars are left in darkness; (3) the high-tension currents constitute a source of danger to the traveling public; (4) the trolley line is unsightly; and (5) overhead wires are a formidable obstruction to firemen engaged in the never pleasant work of fighting fires. Inasmuch as a successful storage battery system would be, both from the point of view of the public and the street car company, what Mr. T. L. Pope calls "an ideal solution of the problem of electrical transportation," it is evident that this system—having total first cost and operating expenses in its favor—is bound to have a speedy and wide development and play no insignificant part in the future history of electric traction in this and other countries.

FINANCIAL NOTES.

YOUNGSTOWN, O.—The Park & Falls Electric Railway Company has voted to increase its capital stock from $50,000 to $200,000.

CHICAGO, ILL —The directors of the West Chicago Railway Company have authorized the issue of $1,000,000 6 per cent. bonds to pay for electrical equipment.

INDIANAPOLIS, IND.—The Indianapolis street railway plant, which has been in receiver's hands for some time, has been sold by the sheriff to Mr. S. A. Fordyce, representing the bondholders. The price paid was $50,000.

TRACTION EARNINGS.—The indications are that the earnings of the Philadelphia Traction Company for the current month will show a gross increase of $50,000 over last September. Baltimore Traction is also improving, the gross earning, for the first 13 days of this month having been $10,000 greater than for the corresponding period in 1894. The statement of the Hestonville system for last week, exclusive of receipts from trolley parties, shows an increase of $5,000 gross earnings, as compared with the same week last year.

NEWS OF THE WEEK.

ALLENTOWN, PA.—The Traction Company's lines will be extended to Hellertown.

DULUTH, MINN.—J. C. Seeley, of Brainerd, is interested in the proposed electric railway across the Crane Lake portage.

BRADFORD, PA.—An ordinance repealing the franchise of the Bradford & Mendall Street Railway has been finally passed.

FONDULAC, WIS.—The old electric railway here has been purchased by the Swartz Metal Refining Company, of Chicago.

MEADVILLE, PA.—Dr. T. B. Lashells and others, of Boston, are interested in the construction of a street railway in Meadville.

TROY, N. Y.—Another extension of the Troy City Railway will soon be made. The new branch will be on Oakwood Avenue.

KIRKSVILLE, MO.—S. M. Pickler and T. J. Dockey are endeavoring to secure a franchise to build an electric railway in Kirkville.

RICHMOND, VA.—The ordinance granting the Broad Street franchise to the Traction Company has been signed by Mayor Taylor.

HANSON, MASS.—The business men of Hanson are raising subscriptions for stock for an electric railway from Hanson to Whitman.

WARREN, O.—The directors of the Trumbull Electric Railway Company have decided to begin work on the extension to West Warren.

BOSTON, MASS.—It is understood that the West End Street Railway Company intends to erect a power house on land recently purchased.

BURLINGTON, VT.—The Military Post Street Railway Extension Company has filed a petition for the location of an electric street railway.

FREDERICK, MD.—The directors of the Frederick & Middletown Electric Railway have decided to soon begin the construction of the road.

OWEGO, N. Y.—F. E. Bard, of New York, is in town looking over the route of the proposed electric road between Owego and Speedsville.

FAIRFIELD, KY.—James McKenna has been appointed treasurer of the organization promoting an electric line from Louisville to Fairfield.

LOS ANGELES, CAL.—Proposals are wanted until Sept. 24 for the purchase of a franchise for an electric railway. T. E. Newlin is county clerk.

BEDFORD CITY, VA.—C. R. Ruffin, of Charlottesville, has applied to the Council of Bedford City for a franchise to construct a street railway.

PITTSTON, PA.—Senator James L. Slocum is interested in a scheme to build an electric railway to connect with the Wilkes Barre & Scranton lines.

McKEESPORT, PA.—An ordinance giving the McKeesport & Portvue Railway Company right over certain private streets has been recommended.

CAIRO, ILL.—An ordinance is before the Council for the granting of a franchise to E. W. Halliday, to construct an electric railway on Syracuse Street.

ASBURY PARK, N. J.—Asbury Park & Belmar Street Railway Company proposes to build a double track electric railway from Asbury Park to Belmar.

DETROIT, MICH.—The Citizens' Company has made application for permission to transform the Bush & Russell streets car line into an electric road.

DETROIT, MICH.—Col. Seymour Brownell, of Detroit, and others are interested in the construction of an electric railway between Detroit and Pontiac.

DENVER, COL.—The West End Street Railway Company has under consideration the extension of its road to Golden. D. F. Longstreet is superintendent.

SHREWSBURY, N. J.—The township committee of Shrewsbury has granted a franchise to the trolley company to build tracks from Eatontown to Red Bank.

BENNINGTON, VT.—The Bennington & Woodford Railway, which has been in operation for two months, has applied for right to extend its tracks beyond Main Street.

MIDDLETOWN, N. Y.—The Traction Company having received its franchise for Bonnell and Stanton Streets, will commence work on the asylum extension at once.

FORT LEE, N. J.—John W. Ferguson, of Paterson, has been awarded the contract to erect a power-house and car shop at Fort Lee for the Bergen Traction Company, to cost $50,000.

YONKERS, N. Y.—The Yonkers Railway Company has decided to lay new girder rails on Main Street, from Buena Vista Avenue to Nepperham Avenue, in place of the old horse-car rails now in use.

SCHUYLKILL HAVEN, PA.—The contract for the construction of a trolley line between Minersville, Sailorsville and Pottsville to Schuylkill Haven has been awarded to Thomas Connell, of Pottsville.

CLEVELAND, O.—An interurban street railway between South Brooklyn, a suburb of Cleveland, and Akron, O., to be operated by electricity, will soon be built. N. W. Baird, 901 Garfield Building, is interested.

SPRINGFIELD, MASS.—The Selectmen of West Springfield have received a petition from President Olmstead, acting in behalf of the Springfield Street Railway Company, asking that a location be fixed on Park Street.

WHITE PLAINS, N Y.—The New York, Elmsford & White Plains Railway Company has applied to the Board of Trustees of White Plains for consent to construct and operate a railway along various streets of the village.

MINERSVILLE, PA.—The Schuylkill Electric Railway Company has awarded to P. F. Connell contracts for building two new trolley lines, one from Minersville to Taylorsville and the other from Pottsville to Schuylkill Haven.

WASHINGTON, PA.—It is understood that the Washington Electric Street Railway Company contemplates an early extension to Canonsburg. Senator Kennedy, of Allegheny, Mr. Torrance and others, of Pittsburg, are interested.

ELLICOTT CITY, MD.—The Schafer-Nichols-Watkins Company, of Nashville, Tenn., contractors for the electric railway from Benzinger's Lane, Catonsville, to Ellicott City, have commenced the grading of that part of the road.

NORFOLK, VA.—The electric line to Lambert's Point is nearing completion, the rails having nearly all been laid and the work of stringing wires commenced. It is thought cars will be able to run over the line in about two weeks.

PATCHOGUE, L. I., N. Y.—J. B. Swezie and Ex-County Clerk Orange T. Fanning, as a committee, are making every possible effort for the speedy culmination of the proposed Cross Island trolley between Port Jefferson and Patchogue.

MONTCLAIR, N. J.—The North Jersey Street Railway Company has presented a petition to the Council of Montclair asking for permission to construct, operate and maintain a single-track street railway on Elm and other streets.

SYRACUSE, N. Y.—The Syracuse & Oneida Lake Electric Railway Company has filed its acceptance of the franchise granted it, which contains the provision that the company shall pay into the city treasury a mill for each passenger carried.

MILFORD, MASS.—A proposition has been made to the electric light company for power to run the cars from Milford to the top of Phipps Hill, in Holliston. A meeting of the electric-light officials will be held at once to take action on the proposition.

LONG ISLAND CITY, N. Y.—The Steinway Railway Company proposes to extend its road from its present tracks at Newtown Road and Broadway, Long Island City, along Newtown Road to Jackson Avenue, to connect with the tracks on that avenue.

EAST MAUCH CHUNK (MAUCH CHUNK) PA.—The proposed borough electric light plant and the electric road extension are now under consideration of the Town Council of East Mauch Chunk. The estimated cost of the electric light plant is $12,500.

CARTHAGE, N. Y.—It is stated that the Central Railway Company has abandoned the idea of building a branch from Carthage to Copenhagen, and the feasibility of an electric road between these places is again under discussion by foreign capitalists.

ALBANY, N. Y.—The railway commissioners have granted the Auburn Inter-Urban Electric Railway Company permission to build a surface line between Auburn, Skaneateles, Port Byron and Weedsport. W. B. Goodell represents the present Auburn City Railway Company.

PHILADELPHIA, PA.—The Delaware County & Philadelphia Electric Railway Company has secured the consent of all interested property owners to its proposed extension on Church Lane, from Baltimore Avenue to Holy Cross Cemetery. The extension will be about a mile in length.

NEW HAVEN, CONN.—President Clark and the officials of the New York, New Haven & Hartford Railway are said to be considering the advisability of equipping the Warwick & Oakland Beach branch of the consolidated road with an electric system similar to that now in successful use on the Nantasket Beach line.

ELIZABETH, N J.—The executive committee of the Board of Trade is negotiating with a syndicate with a view to the extension of the East Jersey Street horse-car line to Rahway and Summit, and the changing over to the trolley system. It is stated that about $300,000 will be spent in the undertaking.

PORTLAND, ME.—A special meeting of the Board of Trade and Aldermen ordered that the location of the Portland & Yarmouth Electric Railway Company be fixed and determined as follows, viz.: Beginning at the intersection of Elm and Congress Streets and running thence to the intersection of Oxford Street, etc.

KEENE, N. H.—An adjourned meeting of the incorporators of the Keene Electric Railway Company was recently held at the office of Hon. Charles Hersey and it was voted to commence as soon as possible the building of an electric road. The directors were authorized to make a contract for the construction of the line.

PORTCHESTER, N. Y.—At a meeting of the Village Board of Trustees John W. Launsbury, president of the White Plains, Portchester, Rye & Harrison Electric Railway Company, presented a petition from his company asking for a franchise to build and operate a cross-county electric surface road on Westchester Avenue in this village.

CHESTER, PA.—The directors of the Media, Middletown, Aston & Chester Electric Railway Company have voted to increase its capital stock from $30,000 to $150,000, and the attorney of the company will go to Harrisburg at once to secure the necessary papers. Next week the plans for the immediate construction of the road will be completed.

COHASSET, MASS.—It is stated on excellent authority that the New York, New Haven & Hartford Railway will at once commence to equip that portion of the road from here to Braintree, a distance of about 15 miles, for running by electricity in connection with the Nantasket Beach branch. Engineers are at work at present taking measurements.

RED BANK, N. J.—The township committee of Shrewsbury met at the Town Hall recently and resolved to pass an ordinance granting to the Atlantic Highlands, Red Bank & Long Branch Electric Railway Company the right to construct, maintain and operate an electric street railway on the Old Turnpike Road, between Red Bank and Eatontown.

FLORENCE, NEB.—It has been decided by the Council that the municipality will hold a special election Sept. 17 to vote on the proposition of granting a bonus of $13,000 to the Omaha & Florence Street Railway Company, to aid in the construction of an electric railway from Ames Avenue to Florence. V. G. Lantry, Walter G. Clark and Fred. Parker are interested.

ST. HELENA, CAL.—The town trustees have granted L. Crothwell a franchise to build an electric road along the main streets of St. Helena, and to construct and operate an electric light plant. Mr. Crothwell already has franchises from the county supervisors and the Napa City trustees, and proposes soon to begin work on the electric road from Napa to Calistoga.

HAMILTON, ONT.—It is stated that the Hamilton Radial Electric Railway Company has closed a contract with the Niagara Power Company which makes the construction of the road a certainty. The company has abandoned the steam railway part of the enterprise and will build an electric road. It is asking the city for right of way along Sherman Avenue and Cannon Street.

PHILADELPHIA, PA.—The Philadelphia Traction Company will consolidate its Christian and Ellsworth Streets and Richmond lines, as soon as these are ready for trolley cars, into a single line. The work of equipping these two lines with the trolley system is nearing completion, and the horse cars, which are the only ones left on the Philadelphia Traction system, will soon be retired.

INDIANAPOLIS, IND.—The Broad Ripple Rapid Transit Company, a suburban line, has filed a petition with the Board of Public Works asking for right of way into the city. The company now enters over the Citizens' Railway Company's tracks. It also proposes to pay the city $500,000 for a franchise through all the streets in 1901, the date of expiration of the present franchise of the Citizens' Company.

PHILADELPHIA, PA.—Within a few days the new power station of the People's Traction Company at Ogontz will be supplying power to the Old York road line. Only one of three large engines and generators at the station is ready, but the additional current which this generator will furnish will enable more cars to be put on Old York road, and permit all the cars to be run at a higher rate of speed up the hills, reducing the time for the trip several minutes.

WORCESTER, MASS.—The officials of the Worcester & Shrewsbury Railway Company are seriously considering the matter of electrically equipping the line between Worcester and Lake Quinsigamond. Their plan does not contemplate the entire abolition of the steam line, but the addition of another rail, making it possible to run trolley cars over the system The tracks are now only 3 feet wide, and in order to run electric cars another rail would have to be laid to make the gauge 4 feet 8½ inches.

MULLICA HILL, PA.—The extension of the trolley through this district is again being agitated by the citizens of this place, and several of the capitalists in the town are negotiating with the Camden, Gloucester & Woodbury Company in the hope of securing the much talked of extension. The trolley company, while not at present prepared to give any definite plans, has gone over the proposed routes, and it is understood that the next move, looking to an extension of the lines, will be in this direction.

MIDDLETOWN, CONN.—The Middletown Street Railway Company, of which Israel A. Kelsey, of West Haven, is a leading official, has obtained the permission to extend its lines to Cromwell, and work of construction will be started at once. The extension is to be three miles long and about $40,000 will be expended on the work. Boston & Maine Railway standard rails are to be used and the overhead equipment is to be very heavy and substantial. Contracts for the construction will be let in a few days, and it is expected the road will be in operation before Winter sets in.

DETROIT, MICH.—Ten conductors and motormen on the Jefferson-Grand River Avenue line have been discharged by General Superintendent Grant, who charged that they had violated a State law in regard to observing proper precautions at steam railway crossings. The specific charges were that they ran over these crossings without stopping or going ahead to see whether or not trains were approaching. At the request of the Street Railway Employees' Association the officers of the Citizens' Company will give a hearing to the men in order that they may present their side of the case.

ALLENTOWN, PA.—The contract for the construction of the track and overhead work of the Allentown & Reading Electric Railway Company has been awarded to E. A. Tennis, and calls for the completion of the work by Jan. 1. The consent of property owners for the construction of this line, which will be 22 miles long, has, it is stated, all been secured. The line will pass through Cedarville, Wescoesville, East Texas, Trexlertown, Breinigsville and Kutztown. The company's power station will be located on the outskirts of Allentown, and the intention is to use the alternating current and alternating-current motors. The road will be the first to be equipped with the alternating-current system.

PHILADELPHIA, PA.—Cars began running on Thursday morning on a new line of the Electric Traction system, using the tracks recently laid on Berks Street and Montgomery Avenue, west of Sixth Street. The route of the new line is as follows: Starting at the Second and Third Streets line's depot, at Frankford and Lehigh Avenues, on Huntingdon to Sixth, to Berks, to Tenth, to South. Returning on South to Eleventh, to Montgomery Avenue, to Marshall, to Berks, to Front, to Cumberland, to the starting point. The return route named is temporary. As soon as a necessary curve is put in the return route will be north on Eleventh Street to Montgomery Avenue, to Marshall, to Berks, to Fifth, to Cumberland, to the starting point. The new line will issue transfers at the usual points and will enable passengers from Kensington to ride to the neighborhood of Tenth and Chestnut streets without change of cars.

NORRISTOWN, PA.—The Chestnut Hill & Norristown Passenger Railway Company a few days ago made a contract with William McGraw by which the Germantown and Perkiomen turnpike will be depressed at Plymouth Meeting, so as to go under the tracks of the Trenton cut-off branch of the Pennsylvania Railway at that point, avoiding a crossing at grade of the two roads. The work is largely a cutting through limestone rock, and the tunnel and its approaches will measure about 1,000 feet. When the work is completed the trolley road will be about 17½ feet below the level of the Pennsylvania Railway tracks, the grade of which will not be changed. Solid stone abutments will support the steam railway tracks, of which there are now two, providing a railway width of 90 feet, which will accommodate, if necessary, six tracks. The width of the turnpike through the cutting will be 40 feet. The approaches will be of stone walls and sodded slopes, and the trolley road will be laid on the north side of the pike. The work is being done in the best manner, in accord with Pennsylvania Railway standards and under the supervision of that company's engineers. The cost of the work is estimated at $20,000, and it is being paid by the Chestnut Hill & Norristown Passenger Railway Company.

PERSONAL NOTE.

MAJOR EDWARD B. IVES has resigned his position as chief engineer of the Electric Traction Company, Philadelphia, to accept a similar place with the Allentown & Reading Electric Railway Company.

TRADE NOTES

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., has just completed for the New Haven Street Railway Company a car barn 86 feet wide and 188 feet long, with slate roof.

H. E. COLLINS & CO., of Pittsburg, Pa., sole agents for the Cahall vertical water-tube boiler, manufactured by the Aultman & Taylor Machinery Company, of Mansfield, O., have just issued a card containing a list of repeated orders received for Cahall boilers, the length of which indicates the great favor with which these boilers are being received.

THE M. C. BULLOCK MANUFACTURING COMPANY, of Chicago, has secured the contract for one 200-hp and one 400-hp central valve Willans engines for the Pabst Light & Power Company, of Milwaukee; the company has also received an order from the Terre Haute (Ind.) Electric Railway Company for a 3,600-hp engine. All these engines are designed for direct-connection to their respective generators.

THE CUTTER ELECTRICAL & MANUFACTURING COMPANY, of 1112 Sansom Street, Philadelphia, has issued a well-executed catalogue of magnetic circuit-breakers, a valuable feature of which is an introductory chapter containing data as to the character of fuse wire and the danger attendant upon relying on fuses entirely for protection to apparatus. A table is given showing the great difference between the rated and actual fusing points of wires from No. 4 to No. 30 B. & S. gauge. The catalogue proper describes magnetic circuit-breakers for direct-current circuits of 110 to 500 volts E. M. F., including one for individual street car service, which should find a wide field of usefulness. The various descriptions are illustrated by excellent engravings.

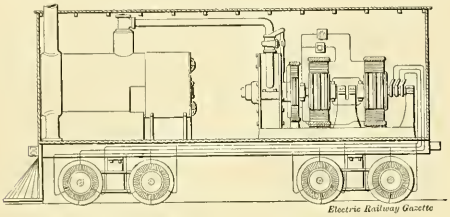
THE ALBERT EDWARDS CAR FENDER COMPANY, of Brooklyn, has been incorporated with headquarters in the Garfield Building, 26 Court Street, in that city. The capital stock is $100,000, and the amount has been paid in. The officers are: President and manager, Albert Edwards; vice-president, Charles McLaughlin; treasurer, Evan J. Rustin; secretary, A. J. Powell, and assistant secretary. Fred W. Cook. The officers of the company are well pleased with the prospects for business, as orders have been received from all parts of the country. The company has received of late a number of exceedingly flattering testimonials. W. H. McKaig, master mechanic of the Atlantic Avenue Railway Company, of Brooklyn, writes to Mr. Edwards as follows: "Allow me to congratulate you upon your trolley fender, as I think, after mature consideration, that it is the best fender brought to my knowledge, its principle being in every way different to the scoop fenders and gridirons; the more I look into it the better I like it, and I cannot see how it can be improved upon." The Brooklyn City Railway Employees' Benevolent Association has adopted the following: "*Resolved*, that after a careful practical examination of the various car fenders brought to our notice in our work as motormen and conductors of the various roads of Brooklyn, we are unanimously of the opinion that the 'Edwards' Automatic Life Saving Car Fender' is in every way the best one and most satisfactory, and would generally relieve our minds and responsibilities if it was generally used on our cars."

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED SEPT. 17, 1895.

545,869. RAIL BOND; Rollin A. Baldwin, South Norwalk, Conn., assignor to himself and Heavlon Rowland, same place. Filed Jan. 24, 1895. The rail bond consists of two plug supports adapted to be attached to the rails, in combination with a connecting conductor consisting of a stiff rod or wire threaded at both ends into the respective plugs and provided with a bend or loop which, when the connector is detached, throws the ends out of line and necessitates distorting the connector to properly connect it with the plugs.

545,872. CAR FENDER; James Bowen, Philadelphia, Pa. Filed June 22, 1895. Frames are suitably supported in hangers attached to the car, and arms extend forwardly from the hangers. Other arms are pivoted thereto, also extending forwardly, means being provided for limiting the downward movement of the arms. Rollers are mounted thereon. A buffer and a netting are provided and a rod extends rearwardly from the upper portion of the frames, and is suitably supported and guided, having a projection on the end thereof. A spring is arranged intermediate the support of the rod and projection, and a collar is attached to the rod and located on the other side of the support.



No. 546,191.—ELECTRIC LOCOMOTIVE.

545,908. STREET CAR BUFFER; George A. Parmenter, Cambridge, Mass. Filed Oct. 26, 1894. This is the combination of a flexible network, having flexible edges entirely around it, with quarter elliptic springs having their inner ends secured to the body of the car and their outer ends to the upper corners of the network. The arrangement is such that the network is stretched tightly between the ends of the springs, without other support than that at the points of attachment thereto.

545,954. CAR BRAKE; Alfred W. Gabrio, Hazleton, Pa. Filed March 14, 1895. In a brake mechanism for car trucks, a series of pivoted brake beams extends horizontally over the car wheels and in the direction of the line of travel. A pair of horizontal rock-shafts is arranged transversely of the truck, with the intermeshing gears on its rock-shafts. There are crank arms on the outer ends of the rock-shafts, and pivoted and adjustable yokes are interposed between the adjacent ends of the brake beams. Pivoted links are interposed between and connecting the yokes and brake beams. The operating crank arms or levers are secured to the rock-shafts intermediate the ends thereof, with links, levers and brake rods adapting the brakes to be operated from either end of the car.

545,993. TRACK CLEANER FOR STREET RAILWAYS; William H. Welton, Akron, O. Filed Feb. 16, 1895. A pair of bars is pivoted to a block attached to the car truck, the ends of the bars being connected by a strap, bearing an adjusting set screw which is arranged to bear against the block and regulate the vertical motion of the bars. A pivoted scraper blade is hung between the other ends of the bars and a spring is fastened to the block arranged to normally press upon the upper part of the blade and retain it in a determined position. An angle plate is attached to the upper and back faces of the blades and adapted to receive the thrust of the spring. A lever is attached to the blade and arranged to rock the blade upward and downward as desired.

546,051. AUTOMATIC RAILWAY SWITCH; William J. McFarland, New York, N. Y., assignor to himself and Thomas H. Baskerville, same place. Filed May 23, 1894. This is the combination on a railway switch mechanism, of a rail switch point and a slot switch point and two directly connected oscillating shafts and means connecting each of the shafts with one of the switch points whereby the oscillation of the shafts actuates the switch points, two movable operating arms being mounted upon two oscillating shafts. The latter shafts are directly connected together to move in opposite directions and connecting means join one of the latter shafts to one of the switch point actuating shafts. A striker arm is carried by a car and adapted to be set into one position to engage with one of the operating arms and into another and different position to engage with the other of the operating arms when the car passes by the arms.

546,059. ELECTRIC RAILWAYS; William M. Schlesinger. Philadelphia, Pa., assignor to John I. McDuffee, trustee, same place. Filed Nov. 24, 1885. A series of separate feeding conductors, extends in multiple arc relation from one generator pole or terminal to points along the line of way with safety devices for the separate conductors. A working conductor, comprising a series of insulated or disconnected sections, is disposed along the line of way, and is supplied by the separate feeding conductors, and return circuit connections are opposed to the sections and lead to the other generator pole or terminal.

546,062. SPEED REGULATOR FOR ELECTRIC CARS; Isaac D. Aiken, New York, N. Y. Filed May 4, 1895. The speed regulator has, in combination with the propelling motors, main rheostat and hand-operating devices, an independent box of resistance coils, supporting, pivotally, a piece provided with an insulated arm, forming a part of the motor circuit, and adapted to be brought into contact with each of the coils. The pivoted piece possesses a second arm, slotted near its outer end to engage a pin projecting from a sleeve, the sleeve being movable upon the axle of the car, and a centrifugal governor.

546,099. SANDING APPARATUS FOR CARS; James H. Hollen, Providence, R. I. Filed July 26, 1895. A cylinder is held in bearings in a hopper, and has a stationary rack inside. There is a telescoping delivery tube for the hopper, and an arm is fast on the shaft of the cylinder and connected by a rod with one arm of a knee-lever connected by a rod from its other arm with another knee-lever in position to be operated by the brakeman on the car.

546,116. STREET CAR GATE; Willard J. Hield, Minneapolis, Minn. Filed Dec. 31, 1894. This is the combination with a car body having a rear end platform, for the entrance or exit of passengers, and a front end platform for the car operator, of a two-wing gate closing the entrance to the rear platform, a drawbar connected to crank arms on the pivot posts of the gate-wings, a drawbar extending forward from the connecting bar to a hand shaft on the operator's platform, and a crank arm on the shaft connected to said drawbar. The crank arm is of less length than the crank arms on the gate-wing posts, so that the hand shaft crank will be thrown by the dead centre either to open or close the gate-wings, and will thereby lock the gate-wings in their open or closed positions.

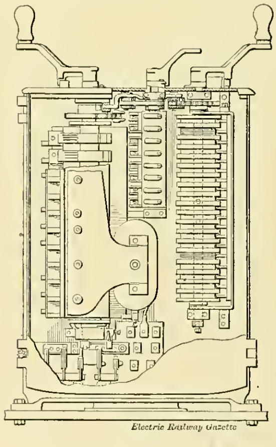
546,120. ELECTRIC BRAKE; William Koedding, St. Louis, Mo. Filed June 13, 1894. The electric brake has a cylinder provided interiorly with coils adapted to be magnetized and arranged in a series with the inner coil in the form of a truncated cone, at its inner extremity. To the plunger is connected a brake rod, and is provided with a coil which has a depression adapted to receive the coil carried by the cylinder when both coils are energized.

546,130. CLOSED-CONDUIT ELECTRIC RAILWAY; John M. Deal, Fernwood, assignor, by direct and mesne assignments, to himself and Samuel Wadworth, Clifton, and William Bartram, Lansdowne, Pa. Filed Nov. 26, 1894. The conduit comprises a trough, two converging side plates thereon, and a longitudinally disposed bar of conducting metal fastened to and between the converging edges of the plates.

546,143. ELECTRIC RAILWAY SYSTEM; Henry A. Fry, Portland, Ore. Filed June 13, 1894. A slot rail has a pendent vertical flange extending down into the conduit. A conductor is located beside the flange, and a trolley having a wheel running against said conductor is provided with an insulated wearing face adapted to abrade against the flange.

546,191. ELECTRIC LOCOMOTIVE; Edwin W. Rice, Jr., Schenectady, N. Y., assignor to the General Electric Company of New York. Filed March 16, 1895. This is the combination in a self-contained electric locomotive, of a prime mover, direct-current generator, and separately excited rotary transformer, with alternating motors mounted on or geared to the axles of the locomotive, and means for varying the periodicity of the current supplied to the motors from the rotary transformer. (See Illustration.)

546,229. RAILWAY CROSSING; Thomas C. Dupont, Johnstown, Pa. Filed July 1, 1895. This is the combination in a railway crossing in combination, two rails, one having a dove-tailed recess across it, and the other having a groove adapted to receive the remaining portion of the first named rail and a beveled portion fitting the dove-tailed recess in the rail.



N . 546,247.—ELECTRIC BRAKE.

546,247. ELECTRIC BRAKE; William B. Potter, Schenectady, N. Y., assignor by mesne assignment to the General Electric Company, of New York, Filed Jan. 19, 1895. In an electric brake, fixed contacts co-operate with a brake switch. There is an idle portion and operative contacts are provided upon the brake switch. A controlling switch is similarly provided with fixed contacts, with operative contacts and an idle portion, and connecting mechanism between the two switches, whereby the fixed contacts of one switch are upon the idle portion of that switch, while the fixed contacts of the other switch are upon the operative contacts of that switch and vice versa. (See Illustration.)

546,257. PROTECTOR-GUARD FOR STREET RAILWAY CARS; Michael Sullivan and Thomas J. Bond, Newport, R. I. Filed March 17, 1894. Renewed Feb. 9, 1895. The guard comprises a fender formed of a rigid cushioned frame and an intervening semi-flexible body, the frame being journaled in braces depending from the car platform. Toggle joints are pivoted to the fender at each side and to loops sliding on vertical rods upon the dashboard. There are set screws in the loops, and chains are secured to the toggle joints and to a horizontal bar at the top of the dashboard; a netting is secured to the front of the fender and to the horizontal bar, and a fastening on the dashboard holds the fender when raised.

Electric Railway Gazette.

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Snaefell Mountain Electric Railway.

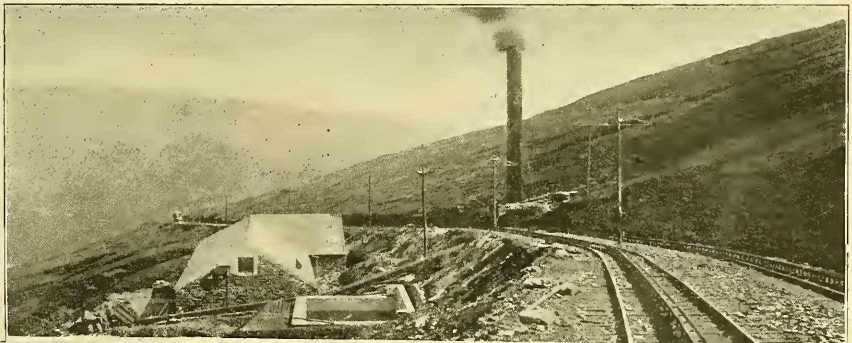
(*From Our London Correspondent.*)

In the Aug. 3d issue of the ELECTRIC RAILWAY GAZETTE appeared a brief reference to the Snaefell Mountain tramway in the Isle of Man, then in course of construction. This line, which is an extension of the Douglas & Laxey electric road, from Laxey to the summit of the mountain, is now completed and in operation. The line is novel and unique—at least so far as Great Britain is concerned. The construction presented many difficulties and involved no little cutting through extended stretches of rock. Gradients are climbed which at some stages are as steep as one foot in twelve, and many long curves were necessary. The highest point reached is 1,820 feet above the sea level.

As the line leaves Laxey at the point where the Douglas & Laxey electric section terminates, the steep slopes of Laxey Glen are surmounted. Not far beyond is that portion of the line which has entailed the most heavy and costly engineering operations, as the line had to be cut through rocky soil. It then extends over high banks supported by massive retaining walls. After passing the Laxey River and the Snaefell Mines the border of the mountain is reached. From this point the line is a continuous ascent, and winding round the mountain to the west it makes a complete circuit of the mountain in order to reach the station at the upper terminus. With the view to insuring safety the Isle of Man Tramway Company adopted the Fell centre-rail system. The bearing rails, laid to a gauge of three feet six inches, weigh 50 pounds to the yard and are made of Cammell's steel. A 65-pound double-headed rail is laid on its side in the middle of the track upon chairs, and is accordingly somewhat higher than the bearing rails. The Fell system is also utilized for traction as well as for safety throughout the entire length. Horizontal wheels are driven by means of a separate motor, so that heavier loads may be carried at a greater speed on steep inclines.

There are arranged upon the bogies of the cars two sets of double wheels which clasp the centre rail and run along it; two gripper brakes manipulated from the driver's cabin add to the power of the ordinary brakes upon the eight wheels of the bogies.

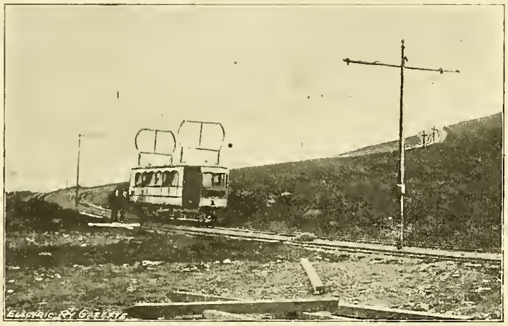
Upon each car there are fitted two sliding collectors, one at each end, which consist of flat steel bars extending transversely across the entire width of the car. These are mounted on the car roof, and are pressed against the overhead conductor by an arrangement of steel spiral springs. The two collectors are cross-connected inside the car. By this system of collection the current is taken from the overhead conductor with



VIEW ON THE ASCENT, SHOWING TRACK CONSTRUCTION AND GENERATING STATION.

STATION AT FOOT OF SNAEFELL MOUNTAIN.

an insignificant amount of sparking, a reasonably small wear of the conductor, and very little noise. Indeed the sparking is only visible at night; the wear has been found on the Douglas-Laxey line to be remarkably small, a "flat" of only one five-hundredth of an inch having been worn during the two years of running; while as to noise, there is nothing of which the running of these cars reminds one more than a steam locomotive with steam slightly escaping from the safety valve.



ONE OF THE CURVES ON THE ASCENT.

The cars are started without altering the relative connections of the motors; or, in other words, the series-parallel system is not in use. Beneath the car bodies, well exposed to the air, are a couple of slate-framed sets of iron-wire resistances; and a start is made in a very simple manner, by throwing these into circuit, and gradually cutting out resistance as the speed rises. On the Snaefell line, the cutting out of resistance is left to the discretion of the motorman, and the only piece of interlocking is that which prevents the motorman from reversing his motors without previously switching them out of the circuit.

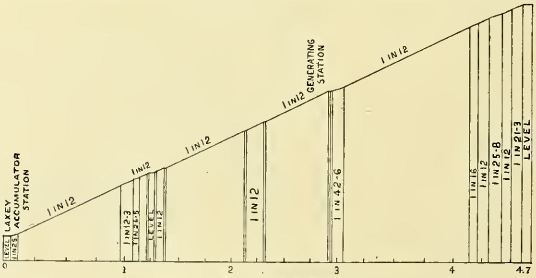
The cars are 35 feet long, the seats having reversible backs. Each axle is driven by a 25-hp Manchester motor, there being four for each car. The motors are single-reduction machines, and are supplied with carbon brushes of Mather & Platt's patent pattern. The driver's cab is equipped with an emergency switch, ammeter, and suitable resistances.

The motors are geared to the car axles by single-reduction four to one spur gears. The wheel and pinion are of hard cast-steel, with the teeth carefully machine cut, to give smooth and silent running and a minimum wear. Normally the four motors will develop a total torque equivalent to a tractive force of 3,500 pounds. The motor armatures are surface-wound Gramme rings, with copper strip winding of ample section to stand heavy starting currents. The system is worked at 500 volts, and the four motors are connected together, two in series and two in parallel.

The generating plant has sufficient capacity to operate three or more cars each loaded with 48 passengers, running at a speed of eight or eight and one half miles an hour under normal conditions of rails and weather.

The overhead system has been adopted. The conducting wires are of No. 0 B. W. G. high conductivity, hard-drawn copper, and are carried upon suitable insulators supported in clips attached to the cross-arms of steel poles between the rails.

A few miles down the line is the generating station, which was designed and constructed by Mather & Platt, of Manchester, who also supplied the plant for the Douglas & Laxey section. The station contains the following plant for generating the necessary power: four Lancashire boilers, each 26 ft. long and 6 ft. 6 inches in diameter, working at 120 pounds pressure per square inch, and capable of giving steam sufficient for 700 hp; and five horizontal-compound engines of over 100 hp each, each of which drives independently a 55 kw generator of the Mather & Platt type. Each dynamo is shunt-wound for an E. M. F. of 550 volts at a speed of 900 revolutions per minute. At one end of the machinery room is the switchboard, which, while simple and unpretentious in appearance, is well adapted to its duties. The board is built, in the usual manner, some little distance from the wall, with a passage-way behind it to enable the connections to be reached. The face of the board is fitted with two Kelvin multicellular voltmeters, one for each section of the line, *i. e.*, the portion above and the portion below the feeding points; it also is provided with an ammeter for each machine, a magnetic blow-out lightning arrester, and an automatic cut-out apparatus which will come into action in the event of a "dead-short" occurring anywhere on the system. By the side of the switchboard is the telephone box, which is in communication with both ends of the line and with the battery house at Laxey. The telephone wires are at present, by-the-bye, carried on the tops of the conductor poles; but we understand it is intended shortly to place them on separate poles. An accumulator station which is situated at the Laxey terminus is fully equipped with a battery of 246 cells of the "S.P." type of chloride cells, the "S.P." signifying that these are specially protected by means of asbestos cloth packing and by special arrangement of the grid, to withstand a very high rate of discharge, such as is inevitable in traction work; or even, for a short period, a complete short-circuit. The cells are contained in strong clear glass vessels, mounted in sawdust trays upon glass insulators, the whole of the battery being supported on a stout timber staging—on one level—set upon an asphalt floor. They are contained within the greater part of a neat wooden building, the lesser portion of which serves the purpose of a switch room, and is separated from the battery room by a wooden partition. These rooms are well ventilated and lit by means of two skylights running along the length of the roof.



PROFILE OF THE ROAD.

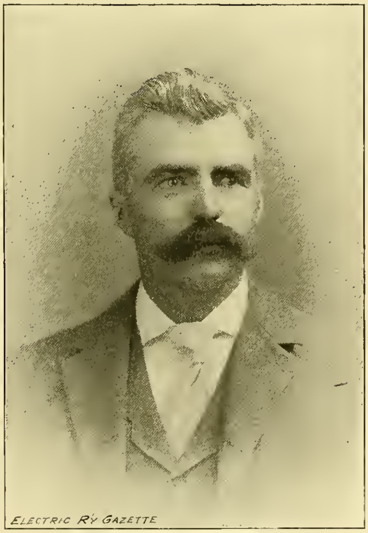
The purpose of the cells is simply to serve as an electrical regulator of the pressure on the line, by which means the variations of supply to the cars might be made without undue fall of pressure and without imposing a sudden great increase of load on the generators. In regard to the steadiness of the pressure, the scarcely perceptible change in the brilliancy of the car light—which are run off the overhead system—when a car is started, shows what success has been attained. And, as to the sudden load on the engines, the gradual creeping-up of the dynamo ammeter readings, and the absence of serious drop in engine speed, show how useful are the cells in this respect.

The tramway was opened to the public on Aug. 22, since which date it has been well patronized by tourists. So satisfactory has been the traffic, and especially that of the Douglas & Laxey section, that a project for continuing the line through Sulby Glen, to connect with the steam railway system between Douglas and Ramsey, is under consideration. The distance is about four miles. The engineers were Alexander McKerrow and G. Noble Fell, of London, whose experience in constructing mountain railways has been extensive. Mr. Fell laid out the line, and has personally superintended the construction. R. N. Willis, of Mather & Platt, has had charge of the electrical equipment.

The Montreal Street Railway Officials.

The portraits of three prominent electric railway men of Montreal who will be active in entertaining the visitors at the Convention of the American Street Railway Association next month are presented herewith:

Mr. Duncan A. McDonald, the superintendent of the Montreal Street Railway Company, is a Canadian of Highland Scotch descent, and was born in Quebec in 1859. He had the good fortune to receive an excellent business and classical education. He was engaged in railway construction in Montreal for several years and then entered the street railway business at the foot of the ladder. He was appointed a driver in Montreal in 1881 and soon after a conductor, serving in the latter capacity until 1882, when he was promoted to the place of inspector, in which position his mathematical training helped him greatly in arranging new and original time schedule improvements, that proved a benefit to the company, and were greatly appreciated by the public. He was afterward appointed head inspector, which position he retained until 1886. For the next four years he was engaged in private business. In 1890, recognizing the advance that had been made in the field of electric traction, he determined to make a study of the new motive system, as he assumed it would soon be adopted in Montreal. He investigated a number of electric railway installations and then entered the service of the Twin City Rapid Transit Company, of Minneapolis and St. Paul. While with this company he gained the knowledge of the work which has qualified him so well to discharge his duties in Montreal. He returned to Montreal in 1892 and re-entered the service of the local company as roadmaster. His promotion to the position of superintendent soon followed as a result of his assiduous work and his demonstrated ability in dealing with electric railway problems. Mr. McDonald speaks and writes English and French with equal facility, an indispensable qualification in Montreal; is gifted with a strong physical constitution, which is absolutely necessary to the superintendent, who



DUNCAN A. McDONALD.

E. LUSHER.

J. F. HILL.

must battle with frost and snow in Canadian winters, and he enjoys a high reputation with the residents of the city.

Mr. E. Lusher, who fills the responsible position of secretary and treasurer of the Montreal Street Railway Company, is the oldest official of that company. For nearly twenty years he has occupied positions of trust and responsibility in the company's service, and during eight years was the company's manager when the lines were operated by horses. Mr. Lusher was elected in 1885 a vice-president of the American Street Railway Association, and is well known in street railway circles in the United States, as well as in Canada. The Association is greatly indebted to him for the fact that the next meeting is to be held in the Dominion.

Mr. J. F. Hill, who from 1883 held important positions as accountant, with the Canadian Pacific Railway and City Corporation of Toronto, was appointed, September, 1892, comptroller of the Montreal Street Railway Company, a position created upon the change in the company's operating system from horses to electricity. Mr. Hill introduced the company's present thorough and complete system of accounting, and also reorganized the accounting of the Richelieu & Ontario Navigation Company, to which he acts as special auditor. Though a young man, Mr. Hill is considered an expert in his profession, having had considerable experience as an accountant, and ably conducts the duties of the position he at present fills.

Electric Locomotives for the Huron Tunnel.

It is stated that the management of the Grand Trunk Railway is figuring on an adoption of electric locomotives to haul its passenger trains through the tunnel under the Detroit River at Port Huron; the locomotives to be similar to those in the Baltimore & Ohio tunnel under Baltimore. A desire to avoid smoke and cinders was among the causes which induced the Baltimore & Ohio company to install electricity. The Grand Trunk is forced to abandon steam engines, so it is said, because of their effect upon the tunnel structure. The latter, cut through the rock, is lined with steel casing, back of which is a filling of what is said to be a peculiar kind of asphalt. The tunnel is a mile and one eighth in length and the grade at both ends is an important one, amounting to 105 feet in the mile. Specically constructed locomotives, weighing 95 tons, and having eight drivers, are used to haul trains through. In developing the energy needed to handle long, heavy trains, it has been found, it is stated, that the excessive heat and escaping steam from the engines is exercising a deteriorating effect upon the asphalt backing, and it is said that steam has been found to exercise a serious influence upon other portions of the tunnel structure.

Winter Trolley Parlor Cars.

Although the Brooklyn Heights Railway Company has had special cars for trolley parties in service but a short time this year, the management is convinced that by their use and operation a considerable amount of new business can be attracted. The company has decided to furnish trolley party cars for Winter use. They will be closed, furnished with easy chairs and rugs and rich hangings. They will be finished in hard woods and plate glass mirrors and no money will be spared to make them attractive.

Different Methods of Operating Electric Railway Motors.

The current issue of the *Transactions* of the American Institute of Electrical Engineers contains the discussion on Dr. Duncan's inaugural address delivered at Niagara which includes some remarks by Mr. C. P. Steinmetz, on one of the points brought out by Dr. Duncan—the different methods of operating electric railway motors. Those enumerated are:

1st. The continuous-current system; 2d. The continuous-current motor operated from an alternating main line by means of rotary converters; 3d. The alternating-current motor. Mr. Steinmetz proceeded to investigate the limits of application of these different systems, and determine in which case the one, and in which case the other, is preferable.

All electric roads, as far as they are in operation to-day, he said, or as we expect to see them introduced in the near future, belong under the following classes:

1st. *Surface roads in the interior of cities.*—On these roads the continuous-current railway motor with overhead trolley and ground return, operating at a potential of 500 to 600 volts, is used practically without any exception. Only very few roads use either an underground conduit or a double trolley. On city surface roads there is at present no hope of seeing the continuous-current motor replaced by any other method of electric propulsion, since the continuous-current motor has proved itself entirely satisfactory under the conditions of such a road, and the distances are such that they can easily be reached by 550 volts, or a three-wire system with 1,100 volts between the outside wires. The double trolley required with alternating-current motors practically excludes them from such roads with many switches and cross-overs.

Only in underground conduit roads can the alternating-current motor be expected to find an application on city surface roads. The double trolley in this case is no objection, since conduit roads operate usually with double trolley, and the alternating-current system offers in this case the advantage of permitting very low voltage at the trolley lines, due to the possibility of feeding by stationary transformers. Thus we may expect to see the alternating-current motor introduced on conduit roads.

2d. *The second application of the electric motor is to elevated roads.*—Here the continuous-current series motor is just being introduced, and there is no hope at present of replacing it with the alternating motor, due to the particular nature of the elevated road service, where trains never run at full speed. Take as an instance the Manhattan Elevated road in New York. Excluding express trains, a train on this road never runs at full speed, because before it has reached that point it has already approached so near to the next station that it has to slow down. It is very readily seen that the alternating-current motor, while it can operate at its proper speed with very high efficiency, and can get any starting torque desired, nevertheless does not give this flexibility of speed, but while accelerating, has to run on the rheostat, and thus does not give the same efficiency as the continuous-current motor under the same condition. For this reason the alternating-current motor is less suited for elevated roads, the more so, since the main advantage of the alternating-current system, the opportunity of feeding by means of stationary transformers, is of no essential value for elevated roads which are of moderate length, and have a very heavy traffic; and where it is thus possible, with a comparatively small investment, to feed the road by continuous current at 500 to 700 volts, or even more, from one or a few power stations. Thus, these two fields of application will be held by the continuous-current motor for a long time to come.

3d. Another field in which the electric railway motor is rapidly gaining is in the *suburban and interurban traffic*, or those lines which extend from the city roads far out in the country, or connect adjacent cities, as for instance the network of railways stretching out from New York City along the Hudson and East Rivers, or from Boston out to Lynn, Salem, Dorchester, etc.

If the length of these roads becomes considerable, it will be impossible to feed by continuous currents from one central station, and thus some other method becomes necessary. Either you have to put frequent power stations along the road, which is, to say the least, awkward and inconvenient, or you have to use alternating current, and in the latter case two possibilities exist: either continuous-current motors on the cars, supplied by rotary converters from alternating main lines, or alternating-current motors on the cars supplied by stationary transformers. Both of these methods offer advantages and disadvantages.

The *system of rotary converters* has the advantage of allowing the use of a standard continuous-current railway motor which is able to run over the city lines also, so that the same cars and motors can be used on city surface roads and suburban and interurban roads, the rotary converter merely taking the place of a supplementary central station. However, in general the speed at which the suburban roads are operated will be higher than the speed of city roads, and thus for this reason special motors, that is, special cars, will be required. Furthermore, the use of a commutator makes it desirable not to exceed 500 to 600 volts at the motor. This voltage means a frequent use of rotary converters along the road, which is objectionable, since the rotary converter, being a revolving machine, requires some attention and supervision—that is, in reality constitutes a sub-station.

The *alternating-current motor* has the disadvantage of requiring a double trolley. This may not be very objectionable on suburban roads with few switches and crossings. It has, however, the essential advantage of running at a fairly constant speed, independent of the load, and will not race when running down hill, but will in this case return the power as generator into the line; nor will it slow down when climbing hills. This is quite a valuable feature in single-track roads, where at present with the continuous-current motor the car going down hill has usually to wait on the switch for the car going up hill. Furthermore, the alternating-current motor is more reliable in its operation, and since the alternating main current enters the motor field only, which is stationary, a higher voltage is permissable; that is, a greater distance between the supply transformers. The main advantage, however, is the possibility of feeding the line by stationary transformers, which need no supervision, but are to be considered merely as a part of the feeders. Thus, on these roads, wherever it is not absolutely essential to run the same cars over continuous-current city roads, the use of alternating-current railway motors on the car, supplied from an alternating-current trolley line, will be preferable to the system of rotary converters.

4th. A further field for electric railroading is to be found in *high-speed, long-distance roads* for mostly passenger traffic, connecting important cities. Thus far nothing has been done in this line, although considerable discussion has taken place. Mr. Steinmetz was sure that the future will bring such roads. It is obvious that in this case only alternating-current motors are applicable, mounted directly on the axles and fed from high-potential mains by transformers. The speed of these roads must be very high, since steam locomotives have already reached a speed of about 100 miles an hour, and there would be no demand for the electric motor if it did not offer an essential advantage over the steam locomotive, and such advantage can only be found in the possibility of using very high speeds, due to the absence of reciprocating motion. Thus speeds of 150 miles per hour maximum, with an average speed of 100 to 120 miles per hour, will be just as safe as the present steam locomotive speeds.

The objection has frequently been raised against the alternating-current motor for railway service, that it does not give sufficient starting torque. This objection holds no longer, for the starting torque of alternating induction motors—for instance, of the three-phase type—far exceeds that of the continuous-current motor. Theoretically this is easy to understand. The torque of a motor—starting torque as well as running torque—is proportional to the product of armature current into field magnetism. In the continuous-current motor at normal running, the field must be fairly near saturation. Thus an increase of field magnetism is possible to a limited extent only, and an increased torque, therefore, requires a nearly proportional increase of current. In the alternating-current motor, however, the field is very far from saturation at normal running, and thus can in emergencies—as when starting on a curve or when climbing heavy grades—be doubled and tripled. Therefore, to get four times the torque in the alternating-current motor, by doubling the field strength, only twice the current will be required, while the continuous-current motor probably requires three or more times the current.

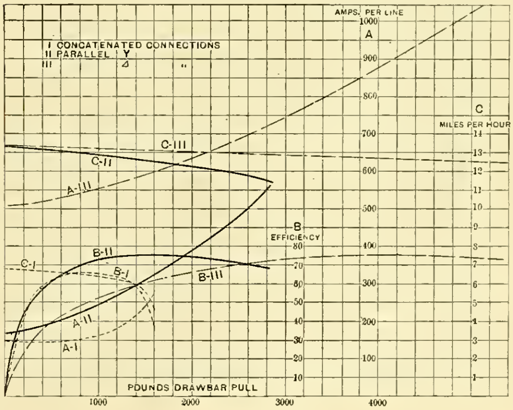


FIG. 1.

Furthermore, the production of heat in the alternating-current motor is distributed over the whole apparatus, and thus a much greater heat can be taken care of for a limited time.

Fig. 1 gives the testing record of a car equipment with two three-phase induction motors. They are designed to operate with the same speed, and are of about the same size and weight as the standard General Electric Company's continuous-current railway motors, G. E.-800. They are controlled by a method devised by Mr. Steinmetz, and whereby it is possible to operate them at full efficiency and half speed as well as full speed, thereby offering the same advantages as the series-parallel control of the continuous-current railway motor. The curves *A* denote current per line required by this motor when operating at its rated voltage of 110 volts between the lines. The curves *B* give the efficiency, including bearing and gear friction. The curve *C* gives the speed—all as function of the drawbar pull, or pull at the periphery of a standard 33-inch wheel. The normal rating of these motors is 800 pounds drawbar pull per motor, or 1,600 pounds per car. As may be seen, in concatenated control, at half speed, the drawbar pull rises to 1,600 pounds, and at full speed to over 2,800 pounds, while by means of an emergency switch which changes the field intensity of the motor, the maximum drawbar pull can be increased to over 8,000 pounds ; that is far beyond the heating limit of the motor and far beyond the pull which will slip the wheels. That means, in other words, that the alternating-current motor can give any starting torque which possibly can be required, just as well as the continuous-current series motor.

In closing the discussion Dr. Duncan said that perhaps the uses of the different methods and their limitations were correctly stated by Mr. Steinmetz. But he did not care to take up the question. He thought we could offer the steam railway people systems that would operate their passenger traffic more economically than it is now being operated. But the question to consider was, whether they are in a condition to accept the offer? There are only a few roads in the United States that are in a condition to accept the electrical benefits we can give them, because no two-track road, without disorganizing its traffic, can get the advantage of electrical transportation. We cannot at present change the method of freight transportation. Dr. Duncan said he was not considering what is going to happen in the future, but the conditions as they exist at the present time. You cannot disorganize the freight traffic, you cannot disorganize through traffic, and with those two kinds of traffic on two tracks, you cannot possibly compete with a parallel line running a regular tramway service. It is not a question of which way we want to equip those tracks, but the thing is that the steam people must give us the tracks to equip, and to secure the benefits of electrical traction we must have four tracks on through roads, and even with four tracks some roads will find it difficult to equip.

We cannot compete for freight traffic by electricity except by using self-contained electric locomotives, in which the electrical apparatus is a mere gearing between the steam and the axle. As far as the principle goes there would be no difference in the character of the service between this and the ordinary steam equipment. But a freight traffic by a trolley system will not be as cheap as the steam traffic. At the present time the condition of affairs is this: The steam roads must compete with the electric roads that are paralleling them, and which are cutting down their receipts, and this can only be done by giving separate tracks for the electric service or by controlling competing roads. As Mr. Steinmetz says, there are a number of ways in which we can equip the roads electrically. Although he has projected a little into the future, yet he has pretty well stated the kind of service we ought to have on the different kinds of roads. But at the present moment, even if he were prepared to sign a contract for any one of the different types of equipment on any one of the different types of road, there are not three or four steam roads in the United States that are prepared to take advantage of it, which was the point taken up in the inaugural address.

The American Street Railway Association.

The fourteenth regular (annual) meeting of the American Street Railway Association will be held in the Windsor Hall, Montreal, Canada, on Tuesday, Oct. 15, commencing at 10 o'clock a. m., and continuing four days. Among other interesting features will be reports of special committees on the following subjects : "Transfers," "Municipal Ordinances," "Labor Question ; Wages Paid to Employees," "Experience of Roads in Furnishing Free Music and Other Entertainments to the Public," and "Physical Operation of Roads."

The executive committee has secured Victoria Rink, Montreal, Canada, for the exhibition of supplies of every nature used in the street railway business. The building has been engaged for two entire weeks, beginning Oct. 9, and ending Oct. 22, thereby giving ample time for the setting up and removal of the largest exhibits. The hall for the meeting is adjacent to the exhibition building, and delegates will therefore be enabled to examine the exhibits to the best advantage and with the least possible loss of time. The exposition department will be in charge of Mr. Stonewall Jackson, 27 St. Sacrament Street, Montreal.

The banquet will take place on Thursday evening, Oct. 17, and each company holding a membership in the Association is entitled to admission for two of its officers. The charge of tickets issued to those not coming under this head will be $10 each for gentlemen and $5 for ladies.

The headquarters of the Association will be at the Windsor Hotel. The rates of the various hotels are as follows: Windsor, $3.50 to $5; St. Lawrence Hall, $2.50 to $4; Queen's, $2 to $3.50; Balmoral, $2 to $3.50; Cadillac, $1.50 to $2. All the above-named hotels are on the American plan, and the rates vary according to the location of rooms. All are within a short distance of Windsor Hall and Victoria Rink. Members who expect to be present should communicate with the proprietors of the hotels as early as possible, to insure pleasant quarters.

The traffic associations have authorized the sale of tickets at reduced rates—namely, a fare and one third for the round trip. This concession applies to all attending the meeting—delegates, supply dealers and accompanying friends. The traffic associations that have extended this courtesy are the Trunk Line Association, the Canadian Pacific Company, the Central Traffic Association, and the Boston Passenger Association. The usual rules applying to reduced rate tickets will be in force.

Arrangements have been made for a special train via New York Central Railway for the accommodation of delegates and others attending the Montreal Convention. The train will leave the Grand Central Station, Forty-second Street, New York, Monday, Oct. 14, at 6 p. m., arriving in Montreal Tuesday morning in time for breakfast. Passengers from Western points can connect with the special train at Utica, N. Y., Monday night, by leaving the following cities at the hours mentioned:

St. Louis, 7:55 p. m., Oct. 13; Cincinnati, 8:25 p. m., Oct. 13, via "Big Four;" Toledo, 9 a. m., Oct. 14; Cleveland, 12:50 p. m., Oct. 14, via Lake Shore; Detroit, 9:40 a. m., Oct. 14, via Michigan Central; Buffalo, 6:50 p. m., Oct. 14; Rochester, 8:43 p. m., Oct. 14; Syracuse, 10:50 p. m., Oct. 14, via New York Central.

Arrangements are being made for a daylight return trip through the beautiful Adirondack scenery, including a stop at Lake Saranac. Further information can be obtained from Mr. John N. Partridge, acting secretary, 166 Montagu Street, Brooklyn.

The Michigan State Street Railway Convention.

The Michigan Street Railway Association held its Fall convention at Grand Rapids, on Sept. 18. Representatives from street railway companies in the following cities were represented: Port Huron, Muskegon, Lansing, St. Joseph and Grand Rapids. The Association, for the most part, devoted itself to an informal discussion of the legislation likely to affect the street railway companies of the State. No papers of a technical character were presented. One of the topics considered was the vestibule law passed at the last session of the legislature. This measure is similar to the law which was adopted in Minnesota, but it does not define the kind of material to be used in the construction of the storm front. Most of the members seemed to favor compliance with the spirit as well as with the letter of the law, as it was said that the winters in Michigan were unusually severe, and that in cold weather motormen needed some kind of protection while performing their duties. It is stated that most of the companies in the State will comply with the law fully 60 days before Jan. 1, when its provisions go into effect. Some of the companies have already attached vestibules to their cars. W. Worth Bean, of the St. Joseph & Benton electric line, stated that he had equipped his cars with vestibules even before the passage of the bill.

The three-cent fare bill introduced at the last session of the legislature was also a topic which interested the members of the Association. The measure was killed in committee as well as the bills which provided for the taxation of the franchises of electric light, electric railway and gas companies. The measures were considered of great importance at the present time, especially in view of the fact that the Detroit Street Railway Company had granted a fare of 3 1-8 cents when eight tickets were purchased. The members of the Association claim that passengers can not be transported, roadbed and electrical apparatus maintained, fair wages paid to employees, 6 per cent. paid on the investment, cars vestibuled and heated by electricity in Winter, open cars provided for the Summer months, and amusements arranged for the enjoyment of the public, unless five-cent fares, with transfers at reasonable distances, can be collected. It is believed that the action taken by the Detroit company in making this low fare will tend to encourage those who are endeavoring by legislative enactment to decrease the general rate of fares on street railways throughout the State. It is also believed that the fact that the franchise of the same company contains a clause permitting the city to purchase the road at the expiration of the franchise privilege, will also serve to strengthen the ranks of those who favor the acquirement of street railway properties by municipalities.

The members also discussed the matter of insuring the buildings and apparatus owned by street railway companies. Several believed in patronizing mutual companies instead of the regular insurance companies. A committee was appointed to investigate the matter and report at the next meeting.

In view of the fact that so many important legislative matters relating to street railways are being generally discussed, and as it was desired that a full expression of opinion of the members in regard to probable legislation should be obtained, it was decided to adjourn the meeting until Dec. 4 next. The present officers of the Association will retain their positions until that time, as follows: President, W. L. Jenks, Port Huron; vice-president, W. Worth Bean, St. Joseph; secretary and treasurer, B. S. Hanchett, Jr., Grand Rapids.

Practical Notes for Motormen—XVI.

BY GEORGE T. HANCHETT.

The Electric Locomotive.—The discussion in this section must be rather of possibilities than achievements, for actual information and experience are very limited to almost every one.

Yet, the time is at hand when the electric locomotive is going to make a bid for supremacy, and it would seem hardly fitting to close this series without casting its horoscope and drawing inferences.

A locomotive, as understood by a railway engineer, is a traction machine of great power, tremendous draw-bar pull and capable of making long runs of 200 or more miles without a stop. It should be able to draw 40 or 50 loaded cars on any railway grade. This means a draw-bar pull of 21,000 pounds for a 600-ton train on a one per cent. grade, which condition is, by no means, extreme.

This factor, heavy draw-bar pull, will be, or in fact is, one of the first obstacles to the production of a successful electric locomotive.

If a locomotive be held rigidly back by a dynamometer and started up, it will pull till it indicates its maximum draw-bar pull, after which the wheels will skid. The heavy weight on the driving wheels allows it to exert a very powerful draw-bar pull before it skids its wheels.

The electric locomotive of equal or even greater power might fail utterly to start a train that the steam locomotive could handle with ease because of its greater weight on the driving wheels.

Here we have reached a point in traction where we can make an equipment too light.

At the World's Fair a rude but popularly interesting test was made on the relative tractive effort of a steam and electric locomotive by causing them to pull in opposite directions on a strong rope. The electric locomotive was dragged about at will by the steam locomotive. The wheels of the electric locomotive were rapidly skidding the other way. Many experts ascribed the victory of the steam locomotive to the fact that its wheels were worn to fit the track better, and hence had a better grip. While to a certain extent this may be true, it is more probable that greater weight on the drivers was the true cause. Friction depends directly on the weight applied, and is largely independent of bearing area, and, theoretically, absolutely so.

Therefore the temptation will be, when there is a long train to haul, to supply each car with a motor or run short trains, precisely as in street railway practice. That is not building electric locomotives, and is one of the circumstances that will hold back their being built.

Of course it is perfectly possible to carry a lot of dead weight on the locomotive, but that is not good engineering. The promising solution at present is to build the motor of cast iron. A cast-iron motor will weigh practically double as much as a steel one of the same power, is easier to machine, and no more expensive if the usual iron-clad types are followed.

At the prevailing traction voltage of 500, the currents that an electric locomotive will require are very heavy; 600 to 800 amperes would be a very common current on such a locomotive as might be used for accommodation service, while heavy freight locomotives would often call for more than 1,000 amperes. The next problem is, then, how to get the power to the locomotives without an enormous cost of copper.

The problem is simply a modified form of power transmission. There is a slight gain in the fact that we are not limited in placing the generating station, but can distribute them along the line; but we are at a disadvantage because human ingenuity has not yet produced an alternate-current motor of variable torque and speed that gives sufficient promise of commercial success. We therefore must use the direct current.

However, direct current is successfully used for the transmission of power, and combined with a system of distributing stations placed at intervals along the line, direct current at high voltage presents one of the most feasible solutions of the problem at present.

It may be argued that a direct-current high-voltage motor requires great care, but it may also be added that so also does a steam locomotive. Electric locomotives, as built to-day, show plainly a curious mixture of street railway and ordinary locomotive practice. The cab of the steam locomotive appears and the motors are down between the wheels in little better position as regards accessibility than a street railway equipment. A road employing experienced steam locomotive engineers can, when the time comes, employ at no greater expense experienced electric locomotive engineers. The demand will create a supply.

In locomotive practice it is perfectly possible to build a convenient and commodious cab that will include the motors. They can then be subjected to the constant care and attention of an experienced man, and by this means one of the greatest obstacles to successful and reliable electric traction is avoided. There are great and immediate possibilities for an electric locomotive employing a direct current of high voltage supplied by a large number of small stations at intervals along the line.

Ultimately, it is probable that alternate currents will furnish a solution of the problem that will be complete. A heavy load of transformers aboard an electric locomotive would be but little objection for reasons already given, but just a proper motor must be found.

Electric locomotives, as built to-day, employ gearless motors of the multipolar type controlled by series-parallel methods. Of course, the whole system is much enlarged and modified from a street railway equipment, but aside from this but little advance has been made. An electric locomotive as built to-day would involve more serious obstacles in the building of an interurban line than an ordinary street railway equipment. Its field at present is the limited field of managing rolling stock yards and as a switching engine.

But after all this the reader may well ask, What is the desirability of a change? What is to be gained by installing the electric locomotive in the place of the steam tractor, even if it be made equally reliable?

There are several important advantages and others that are more or less vague at present, but which show promise of development with the locomotive.

First, and, to the present mind, most important, is the employment of an economical slow-speed engine with a detaching valve gear in place of the slide valve engine, the most primitive steam consumer that we have. There is no doubt that an economic saving of coal would be effected.

Second, and most popular advantage, the possibilities of high speed. The newspapers have spoken enthusiastically of speeds of 90 and 120 miles per hour, and while no commercial speed as high as that has been attained the probabilities of obtaining it are much greater than with a steam locomotive, owing to the absence of reciprocating parts.

Thirdly, a much cleaner service free from soot and cinders.

There are also several advantages which are pushed by the newspapers, but which are not so apparent to the more careful thinker. Prominent among these is: More complete control of the motion of the train and a shorter stopping distance. The power of stopping quickly depends upon the method of braking the train, and if you use air brakes we cannot help forcing better contact on an electrical than on a steam locomotive. There are, of course, possibilities with the electric brake. An important advantage, that in case of accident fewer people would be scalded and burned to death. While the probabilities are that fire would be less prevalent, yet it must be remembered that some of the fires that cause the greatest loss of life in railway accidents are from car stoves rather than locomotive fire boxes. Electric heaters would do away with this, and having eliminated the car stove, the argument becomes more valid. With a trolley system, while it is possible in case of accident that the trolley wire might come down and do some electrocuting and set fires, yet it is not probable. The chances are that the trolley would come off and the whole train would be deprived of light, heat and power, but with them the chances of setting fire to a pile of ruins in which human beings were entangled. The electric locomotive is of the future, but its day has begun. It will demand a class of trained motormen, and it is hoped that this series will be some assistance to those who desire to become conversant.

Cincinnati Trolley Mail.

The trolley mail service is to be introduced in Cincinnati. The Cincinnati Street Railway Company has assured the postmaster of the city of its willingness to lend its aid to the organization of a local mail system which will be in no respect inferior to that of any city in the country.

Ohio Electric Light Association.

The annual meeting of the Ohio Electric Light Association will be held at Piqua, on Tuesday, Oct. 8. The headquarters of the convention will be at the Hotel Plaza.

Street Railway Engineers—XXI.

H. WELLMAN.

Mr. H. Wellman, the superintendent and electrician of the Ashland & Catlettsburg Street Railway Company, of Ashland, Ky., is an enthusiastic student in the practical field of electrical engineering. He was born in Eastern Kentucky and was educated in the schools of that part of the State and in Southern Ohio. From his childhood he was intensely interested in all mechanical pursuits. Before he was 12 years of age he had succeeded in constructing a working steam engine, and before he was 14 he had begun to study the machinist's trade. He engaged in work of this kind in local machine shops in Catlettsburg and subsequently completed his work at the trade at the Chesapeake & Ohio Railway shops in Huntington, W. Va. In 1885 he established the works and repair shops of the H. Wellman Manufacturing Company in Catlettsburg. Shortly afterward he became interested in electrical engineering, to which he has since devoted himself. He worked along the lines of electric lighting and power, and in 1887 designed a six-light incandescent machine. It is a fact worthy of note that the dynamo is still in good working condition. As far back as 1889 he designed several small direct-connected units which were built at his Catlettsburg shops and were put into service in neighboring towns. During the Winter of 1889 and 1890 he devoted his time to the study of electric lighting and railway work in St. Paul and Minneapolis, and returning to Catlettsburg in the latter year, he built the electric light plant for the Carpenter Electric Light & Power Company of that place.

H. WELLMAN.

This plant proved entirely successful, but as its capacity proved insufficient, it was decided to construct a new station. A new company was formed under the old name, Mr. Wellman being one of the incorporators. An advantageous site for a station was selected, and a larger plant was installed under his supervision. He became the superintendent and electrician of the company, and held the position until about three years ago, when he resigned to accept the position which he now holds with the Ashland & Catlettsburg Street Railway Company. This company had obtained franchises for the construction of an electric line on the county roads between the two towns stated in the corporate name. Mr. Wellman superintended the construction, and has operated the line with great success. Mr. Wellman is a hard student, and is constantly engaged in designing new apparatus on various lines of electrical activity. He is now developing several appliances of which it may be expected that something will be heard in the near future. He has made a number of inventions, and has been granted letters patent for a system for the electromagnetic mooring of vessels and ferryboats to docks and slips, and for a system of magnetic adhesion for towing vessels and barges.

Jungfrau Electric Railway.

The methods to be pursued in the construction of an electric railway up the Jungfrau have been latterly studied by a scientific commission. Trigomometric and phogrammatic surveys are to be made from the lower station at the Eiger glacier to the summit. Two routes are proposed from the Scheideggs to the Eiger glacier, and the one selected is to be laid out at once, so that the work of construction may commence in the Spring. Prizes amounting to 20,000 francs will be offered for the electrical apparatus, the superstructure and the rolling stock. The aggregate water power available is estimated at 7,000 to 8,000 hp. The distance from the first primary station to the lower end of the road will be about 3¾ miles, and this section will be built as quickly as possible. On further extension of the tunnel construction, a second primary station will be established 3½ to 3 miles further on. The whole line will be 7⅝ miles long, and for working it the two primary stations are to be connected. It is intended to limit the speed to 5½ miles per hour on grades of 792 feet per mile or less, and to 4¼ miles on steeper grades. The steepest is to be 1 in 4, or 1,320 feet per mile. The gauge is 1 metre; the sharpest curve of 327 feet radius. The tunnel, which will begin at the Eiger glacier, will be 10 feet 6 inches wide and 13 feet high.

The British Association Meeting.

The British Association meeting, which concluded at Ipswich (Eng.) on Sept. 17, heard several papers of direct interest to electric traction men.

Maj.-Gen. Webber, C.B.R.E., dealt with light railways in their relation to the development of rural districts, and the economical transport of agriculture, farm, dairy and other produce from country places to towns. He advocated the employment of electric traction as the more suitable system for such purposes, giving as an instance the Portrush & Giants' Causeway electric tramway, which has been running in Ireland for 12 to 14 years, and recommending the construction of such railways as that in different parts of England.

Mr. Philip Dawson read a paper on "The Modern Applications of Electricity to Traction Purposes," in which he gave a summary of all that had been introduced in the way of plant and apparatus for electric traction at different stages. The paper was a very lengthy one, and there accompanied it a very complete table of electric tramways in operation in Europe.

The British Association will meet at Toronto in the year 1897.

Pole Tax Legal in McKeesport.

In the case of the city of McKeesport, Pa., against the Citizens' Passenger Railway Company, Judge White has filed an opinion holding that the city ordinance imposing a $1 tax on each pole for railway or other wires is legal.

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A MOUNTAIN RAILWAY.

In another column we print an account of a British mountain electric railway comprising several features of interest. While the difficulties presented in the design and execution of the project are scarcely to be compared with those encountered in connection with some of the Swiss mountain roads, yet they were more special than anything British traction engineers have thus far attempted, and seem to have been skillfully overcome. To the American engineer the type of trolley used will appear odd, but with the steep gradients on the Snaefell road, the advantage possessed over the familiar type of never by any possibility losing contact with the trolley wire, would seem to more than excuse the employment of an arrangement which otherwise might be considered rather crude. The Fell centre-rail system of traction has given very good results in Switzerland, and its adoption in the country of conservative ideas is a testimonial of merit which will probably definitely establish its engineering status. The employment of a storage battery for the regulation of the voltage is an admirable feature and one which we should like to see more frequently adopted in other cases. In the present instance, where steep gradients and sharp curves cause the load on the station to fluctuate greatly, it will serve an excellent purpose, both in relieving the generating machinery of undue strain and in enhancing the economy of operation.

STREET RAILWAY LEGISLATION.

It is noticeable that the questions which proved of special interest at the convention of the Michigan State Street Railway Association last week related, almost without an exception, to measures likely to come before the next legislature of the State. No little hostile legislation has already been proposed in Michigan, and it is not because the street railway interests of the State have combined to protect their investments that these measures are not on the statute books to-day. There has been opposition to this proposed prejudicial legislation, but it has been due to the energetic efforts of a few individuals, rather than to a representation of the entire street railway interests. This is altogether wrong. There should be a strong body to perform such work as is done by the New York State Association. Michigan is not to be blessed by a legislative session this year, and, as a consequence, the possibility of the passage of hostile acts does not create the alarm which often leads to the formation of effective organizations, but we trust that members of the Association will succeed in arousing sufficient interest to bring into existence a strong, compact body, able to resist the enactment of hostile legislation in 1897, when the next session will commence. It has been suggested, and with a great deal of force, we think, that good might follow the active co-operation of the State street railway and electric light associations. Certainly, in a great many respects, their interests are identical, and joint action would in many particulars greatly improve the chances of the opposition to certain legislation. At the present time we consider it hardly possible to overstate the importance of strengthening the State organizations. The most casual observer may discover a tendency toward legislation unfair to street railway corporations, and unless they take measures to resist them, we do not know who is likely to champion their cause.

ALTERNATING-CURRENT RAILWAY MOTORS.

The opinion seems to be general that there are grave, if not insurmountable, difficulties in the way of the adoption of the alternating current for railway work. The newness of induction motors and the little employment they have thus far received in this country may account for this misconception, which has, so far as we know, the support of no authority. Dr. Bell early pointed out that the induction railway motor presented no particular problem, and in this issue we print the remarks of Mr. Steinmetz in the discussion of Dr. Duncan's inaugural address before the American Institute of Electrical Engineers, in which the same stand is taken. Mr. Steinmetz considers the general question of the methods of operating electric railway motors, his contribution to the subject being perhaps the broadest and ablest yet made, and one which should command the attention of every one interested in electric railways in any capacity. As will be seen, Mr. Steinmetz considers that on the ordinary electric road there is no probability at present of the continuous-current motor being displaced by any other method of electric propulsion, partly for the reason that the conditions render it entirely satisfactory for the service it has to perform, and partly because the alternating current would necessitate the employment of a double trolley. In this connection it may be mentioned that the double trolley apparently presents no considerable disadvantages to the Japanese, as it has recently been adopted by them for use in connection with continuous currents on a great system of electric roads to be laid down in Tokio. The continuous-current motor is also pronounced best for elevated railways, the reason advanced being that while the alternating-current motor has a high efficiency at normal speed, it does not offer the flexibility of speed necessitated by the usual conditions of elevated railway service. For suburban and interurban traffic, however, the alternating current is declared in most cases to be better than the continuous current, while for long-distance and high-speed service the former alone is practicable. As to the two methods of utilizing the alternating current—by rotary transformers and continuous-current motors, or ordinary transformers and induction motors—the former combines the advantages of a single trolley and ability to transfer and run on ordinary trolley roads where necessary, and has the disadvantages of complication and less efficiency. Whether the employment of the alternating-current motor in electric railway work will be greater or less than indicated above can only be determined by experience, for it often happens that practice plays havoc with *a priori* objections and develops unthought of difficulties. In the present instance the question of the double trolley seems to have been given undue weight, since, as far as construction is concerned, it introduces no particular complication nor adds any practical difficulty in operation. A point brought out strongly by Mr. Steinmetz is in regard to the starting torque of induction motors, which is declared to far exceed that of the continuous-current motor. A most widely held objection against this type of motor is thus disposed of, and there is left to counterbalance the many advantages otherwise possessed only the disadvantage of inefficiency in gathering acceleration, which is referred to as an objection against its use on elevated railways. In the future, when greater use has made us better acquainted with the induction motor, it is not unreasonable to believe that this defect will be overcome or found to have less weight than supposed. However this may be, the remarks of Mr. Steinmetz indicate that it is not only possible to apply the alternating current to electric railway work, but that at the present day there are no practical difficulties in the way of its immediate adoption.

To Enjoin the Burial of Feeder Cables.

A suit to enjoin an electric railway company from laying wires underground is a novel proceeding. The Dublin Southeastern Tramways Company, however, was recently compelled to defend an action of this kind. Ordinarily, proceedings are begun not to prevent the burial of wires, but to enforce it. The Dublin Company proposed to lay feeder cables in a trench along the road it is constructing. The injunction was prayed for on the ground that the line at present occupied the greater portion of the street, and as the trench would occupy a great portion of the side of the road, it would be in many ways a great public inconvenience and danger, and render it difficult to run gas pipes, water pipes and drains to the adjoining houses. J. Clifton Robinson, the engineer of the company, presented an affidavit demonstrating that feeder cables were absolutely essential to the operation of the road. He showed that if the defendants were allowed they could open the line by Oct. 1; if not, 200 men would be thrown out of employment. The company had spent £130,000 on the work already, he stated. The court refused the application.

Electric Equipment on the Illinois Central.

A special meeting of the stockholders of the Illinois Central Railway has been called for Nov. 26, at Chicago, to ratify the directors' decision to use electricity in its suburban service. At that meeting the stockholders will be asked to increase the capital stock of the company from $50,000,000, to $60,000,000, one half of this increase to be spent in and around Chicago, the other half to be used in the extension of the southern system. The latter portion of this statement is not official, but it comes from such excellent authority that there is small ground for questioning it.

Bids have already been secured from builders of electrical appliances for the complete equipment of the system. It is estimated that the entire cost will be from $3,000,000 to $4,000,000. This will include the substitution of electricity for steam as the motive power in the company's car shops at Burnside.

The Union Traction Company.

At a meeting, on Thursday, Sept. 26, of the representatives of the People's, Philadelphia and Electric Traction companies, who have been busy arranging the form of the lease of the Philadelphia Traction to the Union Traction Company, it developed that there were matters still unadjusted, but which, it is hoped, may be arranged in a day or two at the outside. The representatives of the three companies hoped to have the lease ready to submit to the stockholders of the Philadelphia Traction Company at Thursday's meeting, and numerous conferences, attended by themselves and counsel, were held with that end in view. But failing to agree on all the points in time for the meeting, it is likely that progress will be made more leisurely now, though the conclusive steps will not be delayed unnecessarily and final action may be reached as quickly as was the determination to consolidate two months ago.

At the meeting of the People's Traction stockholders on Thursday no action was taken on the question of the reduction of the capital stock, the meeting adjourning until Nov. 2. The Philadelphia Traction stockholders at their meeting authorized the board of directors of the company to ratify the proposed lease, instead of providing for a direct ratification by the stockholders, as is customary. In both cases it is understood the action of the meeting was owing to the incomplete state of the issue, and was expected by those close to the management.

All of the gentlemen who manage the three great properties which are to be consolidated reiterated most emphatically that the union would be effected, and said that progress could not be otherwise than gradual in arranging the lease of so extensive a property as the Philadelphia Traction to a company composed of joint interests equally as great.

It was stated that one reason for the delay is that the officers of the People's and Electric Traction companies only received the lease on Monday or Tuesday, and had not had time to examine it properly, and found that, from their point of view, some of the details were not satisfactory.

In explanation of the adjournment of the meeting of the People's stockholders, without taking action on the proposition to reduce the capital from $10,000,000 to $6,000,000, it was stated that it was not thought advisable to take any action before the lease was signed and everything settled. In the possibility of the present plan of consolidation failing, which, while the possibility exists, no one expects, the People's Company might wish to make other arrangements, and would be at a disadvantage with its capital reduced. It was considered best to be on the safe side. The postponement of the People's meeting will not, it is said, delay the negotiations nor the signing of the lease in any way.

It was stated late Thursday afternoon that, in agreeing that the Union Traction Company shall take the $5,000,000 and more of securities in the treasury of the Philadelphia Traction Company, and assume the floating debt and cost of completing all work now under way up to a limit of $4,000,000, the representatives of the People's and Electric Traction companies desired that the lease should provide that, in case the debt should exceed that amount, the Union Traction Company should pay it out of the fund applicable for rental to the Philadelphia Traction, deducting it from the rental.

The Philadelphia Traction managers, it is asserted, are confident that the indebtedness will not exceed the sum mentioned, which has been carefully estimated, though it is stated that the original estimate made when consolidation was first agreed on was less than $4,000,000.

Proposed Electric Passenger and Freight Line.

An electric freight and passenger railway is about to be tried in St. Louis County, Mo. A company has been organized and the necessary State and county franchises secured. About 90 per cent. of the distance is covered by a right of way over private property. The eastern terminus of the line is at the intersection of Loughborough Avenue and Gravois road. From this point the survey extends in a southwesterly direction about midway between the Iron Mountain and Frisco Railways to Morse's Mill, in Jefferson County, a distance of 35 miles. At this point the company owns in fee simple a water-power which has been pronounced by expert electricians capable of generating sufficient power to operate the entire road. But to prevent any hitch, the company will erect a steam power-house, somewhere on the line, four or five miles from the city. The proposed line extends through a rich farming territory that has heretofore depended solely on the Gravois road as the only outlet for its products and inlet for its merchandise. There are located on the proposed line nine post offices, six flour mills, 26 merchandise stores and other business enterprises that transport everything they have to buy and sell by wagon to and from St. Louis. It is estimated that over 50,000 tons of produce and merchandise is transported by the residents of this section annually.

Manufacturing to Be Resumed at Newburyport.

The manufacture of street cars is to be resumed at Newburyport, Mass. About a year ago several of the Newburyport Car Manufacturing Company's buildings were destroyed by fire, and manufacturing was discontinued. Through the efforts of Hon. E. P. Shaw, who was president of the old company; W. B. Ferguson, who is prominently identified with street railway interests in New England, and Messrs. Evans and Pattriquin, a new company, under the old name, has been formed, and business will hereafter be conducted on the co-operative plan. The old master mechanics who were employed at the works previous to the fire have heartily taken hold of the enterprise, and the capital stock of $25,000 has all been issued. Contracts for erecting new buildings and repairing old ones have been made, and a force of men has begun work in order to get the plant in readiness for the Winter's work.

It is expected that within a month 50 men will be employed, and the force will be constantly increased. Several orders have been closed and others are pending.

An Electric Celebration.

The completion of the electric power transmission line which extends from the waterfall at Folsom, Cal., to Sacramento, was celebrated in the latter city recently. The power is used for the electric railway system and for electric lighting. In the evening the city was a blaze of light, and in the parade the designs on the floats were outlined by electric lamps of varying capacity, ranging from two to 200 cp.

Electric Car Tests.

BY HERMANN S. HERING, M.E.

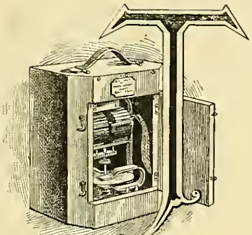
Assisted by

CHARLES REUTLINGER and B. HARRISON BRANCH.

III.—SPECIAL CAR TESTS.

(*Continued from page 180.*)

Pikesville Road, Second Test.



THIS test was made on June 8, 1894, after 68 per cent. of the road had been double-tracked, and some of the curves improved, and the object was to determine what effect the alterations in the track had upon the operation. The test was made in the same way as the first one just described, and the car equipped with the same instruments except that in addition it had a portable form of Thomson recording wattmeter and a Boyer speed recorder, from which latter the autographic record of the speed was obtained.

In double-tracking the road the poles were slightly altered, and consequently they were renumbered, and some changes were made in the curves, but the two ends of the road remained the same. Car No. 234 was used for this second test, and while not the same as No. 233, the one used in the first test, they were near enough alike to be considered the same for all practical purposes. The car was operated by the same motorman, and he was given the same instructions, namely, to run over the route on express time with no unnecessary stop or delay.

Fig. 17 contains the plot of the results obtained from the second test in going from Baltimore to Pikesville, and Fig. 18 from Pikesville to Baltimore. The readings were taken and the results computed and plotted in practically the same manner as in the first test. Both the new and the old poles, as well as the new and old track, are plotted, in order that the alterations may readily be seen. More poles were put around the curves in the new track, and several of the curves were given a larger radius and made compound. One turnout was added near Pikesville, and five turnouts removed. Some feeders were added, it being the intention of the company to increase the feeders along the entire length, but for unavoidable causes work in this direction was stopped, which accounts for the fact that only a small portion of the new feeders were run, and these, as shown in the diagram, are of very little use at the present time, but it was intended that they should form part of a new system of feeders to be erected in the near future; in fact, at the time of writing, some of the

TABLE IV.—GRADES OF THE PIKESVILLE ROAD.
(After alterations.)
THE VALUES ARE GIVEN OF THE GRADES AT THE POLES.

Pole number (new.)	Grade in per cent.	Pole number (new).	Grade in per cent.	Pole number (new).	Grade in per cent.	Pole number (new).	Grade in per cent.	Pole number (new).	Grade in per cent.	Pole number (new).	Grade in per cent.
B'lti-more	(F'l'n Ave).										
15	+4.32	66	+3.15	117	+0.90	168	+0.60	219	−3.65	270	+0.20
16	+3.40	67	+3.00	118	+0.62	169	"	220	"	271	"
17	+1.20	68	+2.60	119	"	170	"	221	"	272	"
18	−0.60	69	"	120	"	171	"	222	−1.20	273	"
19	−1.35	70	"	121	+0.48	172	+0.45	223	−0.60	274	+0.50
20	+0.30	71	"	122	+0.20	173	−0.06	224	−0.10	275	+0.70
21	+0.70	72	"	123	−0.10	174	−0.40	225	"	276	"
22	+2.60	73	"	124	"	175	"	226	"	277	"
23	+5.00	74	"	125	"	176	"	227	"	278	"
24	+5.96	75	"	126	"	177	"	228	"	279	"
25	"	76	"	127	"	178	"	229	"	280	"
26	"	77	"	128	"	179	"	230	"	281	"
27	"	78	+1.60	129	"	180	"	231	"	282	"
28	"	79	+1.00	130	"	181	+0.40	232	"	283	"
29	"	80	+0.50	131	"	182	+0.50	233	"	284	"
30	"	81	−0.06	132	"	183	+1.40	234	"	285	"
31	"	82	−0.60	133	+0.30	184	+2.00	235	"	286	"
32	+5.40	83	−1.20	134	+0.75	185	"	236	"	287	"
33	+4.50	84	−1.95	135	+1.20	186	+1.20	237	"	288	"
34	+3.00	85	−1.50	136	+1.72	187	+0.80	238	"	289	"
35	+1.00	86	−0.50	137	"	188	0	239	"	290	+1.20
36	+1.00	87	+0.60	138	"	189	−0.70	240	+0.40	291	"
37	−0.10	88	+1.50	139	"	190	"	241	+0.85	292	"
38	−1.80	89	+2.40	140	"	191	"	242	"	293	"
39	−3.45	90	+2.80	141	"	192	"	243	"	294	"
40	"	91	+1.70	142	"	193	"	244	"	295	"
41	"	92	+0.55	143	+1.40	194	−0.45	245	"	296	"
42	−2.05	93	−0.20	144	+1.20	195	−0.25	246	"	297	−0.25
43	−0.70	94	"	145	+1.00	196	−0.20	247	+1.20	298	−1.60
44	+0.75	95	"	146	+0.80	197	+0.05	248	+1.80	299	0
45	+2.25	96	"	147	+0.60	198	+1.30	249	+2.15	300	0
46	"	97	"	148	+0.50	199	"	250	+1.35	301	0
47	"	98	"	149	+0.30	200	"	251	+0.60	302	+0.50
48	"	99	"	150	0	201	"	252	−0.06	303	+0.90
49	"	100	+0.15	151	0	202	"	253	−1.00	304	+1.30
50	+1.50	101	+0.60	152	0	203	"	254	−0.80	305	"
51	−0.25	102	+1.12	153	0	204	"	255	−0.25	306	+2.10
52	−1.25	103	"	154	+0.20	205	"	256	+0.50	307	+2.60
53	+0.25	104	"	155	+0.25	206	"	257	+1.10	308	"
54	+1.55	105	"	156	+0.60	207	"	258	+1.60	309	"
55	"	106	"	157	"	208	"	259	+1.90	310	+1.80
56	+2.50	107	"	158	"	209	"	260	+1.40	311	+1.35
57	+3.30	108	"	159	"	210	"	261	+0.90	312	"
58	+4.15	109	"	160	"	211	"	262	+0.50	313	"
59	+3.00	110	+1.50	161	"	212	0	263	+0.20	314	"
60	+1.90	111	"	162	"	213	−0.30	264	"	315	"
61	+2.50	112	"	163	"	214	−0.50	265	"	316	"
62	+3.80	113	"	164	"	215	−0.70	266	"	317	"
63	"	114	+1.35	165	"	216	−0.95	267	"	318	"
64	"	115	+1.10	166	"	217	−1.20	268	"	319	+0.80
65	"	116	+1.00	167	"	218	−1.50	269	"	Pikesville.	

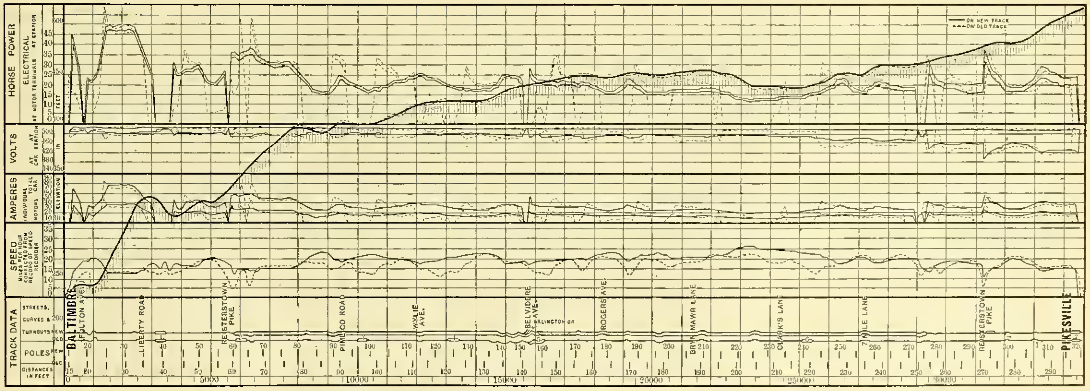


FIG 19.—COMPARISON OF GOING AND RETURN TRIPS, SPECIAL CAR TEST, PIKESVILLE ROAD, JUNE 8, 1894.
Portions of Figs. 17 and 18 superimposed.

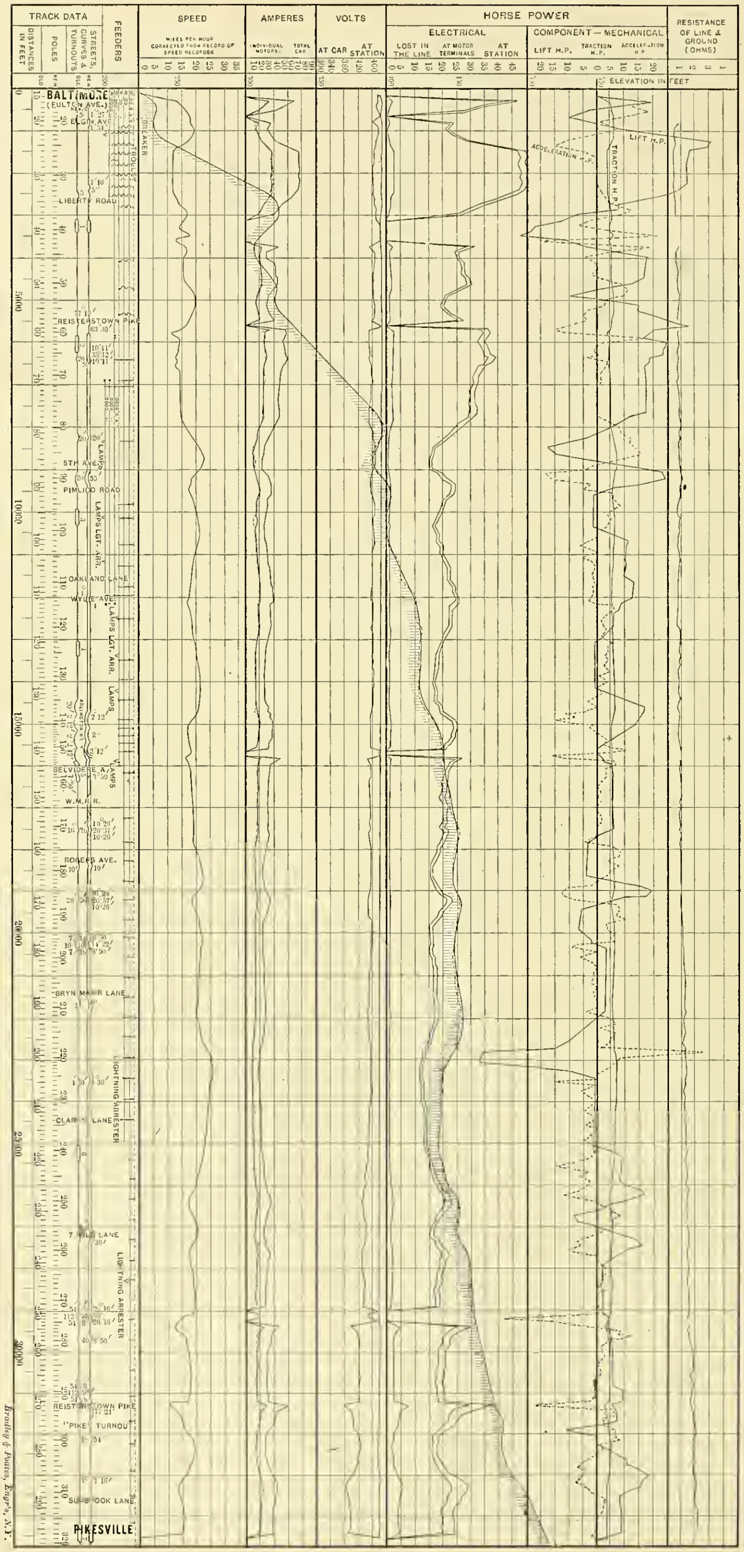
new feeders are already being strung, and the Baltimore end of the road is also being double-tracked.

The speed curve in Figs. 17 and 18 was replotted from the autographic record, as the scale of the Boyer recorder was not the same as that used in the plot of the tests. Figs. 17 and 18 also show, by means of dotted lines, the profile of the road before double-tracking, and the alteration in the grades can thus be seen. The curve of amperes shows that the two motors ran together very well, using practically the same amount of current.

Table IV (see page 221) contains the values of the grades at every pole. Those marked + are "up grade," and — "down grade" from Baltimore to Pikesville. The values of any grade on the road can be obtained when desired by getting the number of the pole from the diagram in Figs. 17 and 18 and then referring to the table.

Fig. 19 (see page 221), which was obtained in the same manner as Fig. 16 (see page 176), shows the values of the speed, current, voltage and horse-power of the outgoing and return trips plotted on the same base, in order that the difference in the two sets of results can readily be seen, the dotted lines as before representing the values of the return trip.

In order to facilitate the comparison of the curves obtained in the second test with those obtained in the first, the two plots were superimposed and are given in Figs. 20 and 21, (see page 224) and the difference in the character of the performance can readily be seen. Fig. 20 contains the track data, profile, and curves



Bradley & Poates, Engr's, N.Y.

FIG. 17.—CAR AND ROUTE DATA OF SPECIAL CAR TEST, PIKESVILLE ROAD, JUNE 8, 1894.

Car No. 234 run over entire route; no other car on the road at the time. Car equipped with two No. 3 Westinghouse S. R. 25-hp motors and "G" controllers. Weight of car and load, 17,313 pounds actual. Plotted on a distance base of entire car-route.

A.—BALTIMORE TO PIKESVILLE.

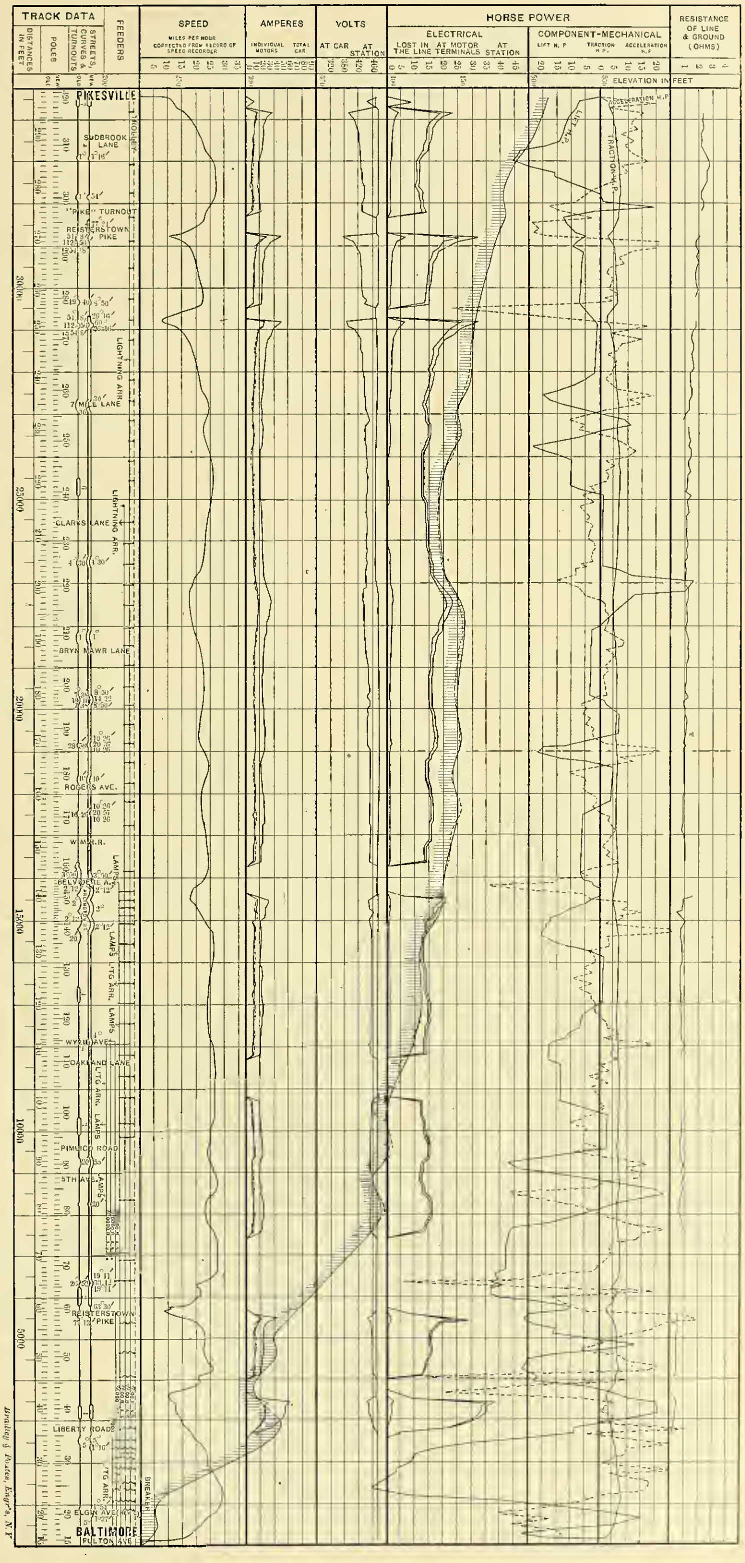


FIG. 18—CAR AND ROUTE DATA OF SPECIAL CAR TEST, PIKESVILLE ROAD, JUNE 8, 1894.

Car No. 231 run over the entire route; no other car on the road at the time. Car equipped with two No. 3 Westinghouse S. R. 25-hp motors and "G" controllers. Weight of car and load, 17,313 pounds actual. Plotted on a distance base of entire car-route. B—PIKESVILLE TO BALTIMORE.

Bradley & Poates, Engr's, N.Y.

of speed, amperes, volts and horse-power of Figs. 14 and 17 which are the outgoing trips of both tests, and Fig. 21 those of Figs. 15 and 18, the return trips. The dotted lines indicate the curves of the first tests, which are those of Figs. 14 and 15. (See pp. 178–179.)

On comparing the curves of the two tests the difference in the performance of the car is quite noticeable. The speed is much more uniform in the second, due to the fact that so many turnouts were avoided, and that the curves were so designed that the motor could run over them at full speed. The single-track ends of the road give very similar results in both tests, the main difference being in the double-tracked portion. The average speed was about two miles per hour greater than in the first test, and the time interval about six minutes less in the round trip. It will be noticed that the current was on the motors over the entire double-track portion with the exception of the crossing at Belvidere Avenue where the Arlington branch road begins. While the road was single-track this could not have been done owing to the frequent retardations necessitated by the turnouts and sharper curves, as illustrated in the plot of the first test. The more uniform character of the performance of the car during the second test than in the first is quite marked, and although the current was on for a longer time, the average during the portion of the road on which power was used was less, and on account of the shorter time interval the total energy for the round trip was less. In the second test the average current going was 33.8 amperes as compared with 38.6 in the first, and returning was 23.9 as compared with 22.8, which was slightly greater, but for the round trip it was 29.1 amperes as compared with 31.3. During the first test no wattmeter was used on the car, and no comparison between wattmeter readings can therefore be made. The portion of the road over which power was used in going was 98.9 per cent. in the second test, as compared with 64 per cent. in the first, and 81.2 per cent. as compared with 54 per cent. returning, and 90 per cent. as compared with 59 per cent. for the round trip. The mean line resistance of 1.1 ohms was less than 1.4 ohms of the first test, probably on account of the improved bonding, and the horse-power lost in the line in the second test was only 7.3 per cent. as compared with 9.3 in the first test, probably for the same reason.

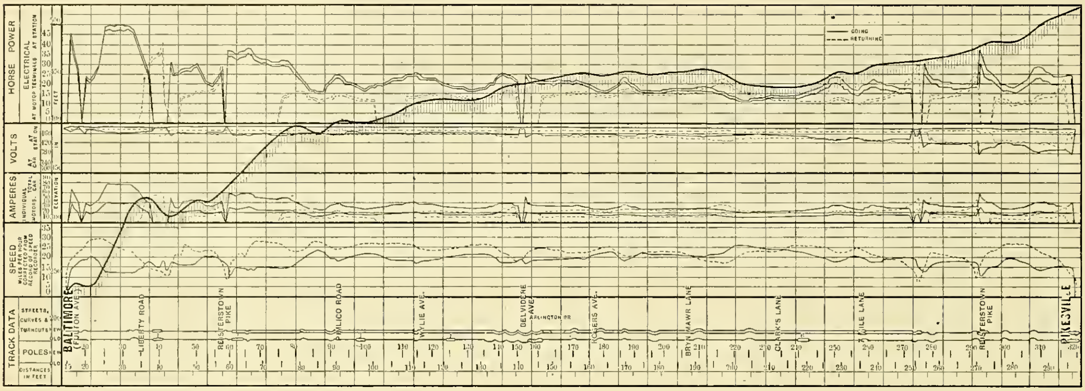


FIG. 20.—COMPARISON OF GOING TRIPS, SPECIAL CAR TEST, PIKESVILLE ROAD, JUNE 21, 1893, AND JUNE 8, 1894.
Portions of Figs. 14 and 17 superimposed.

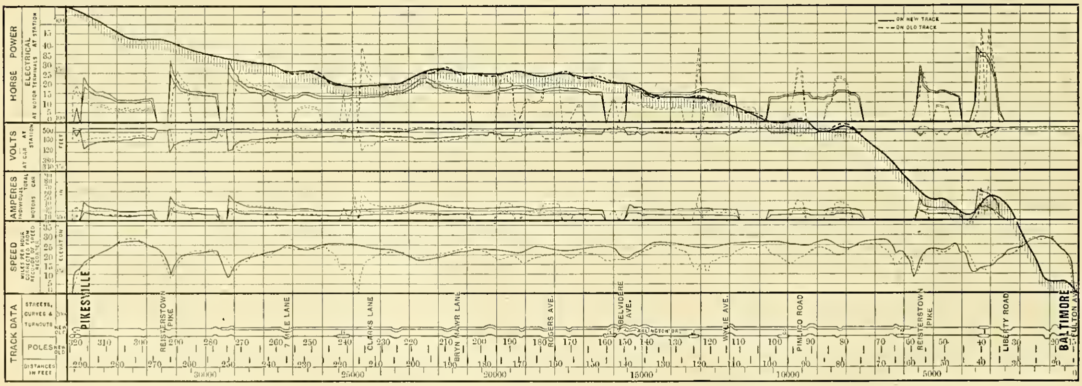


FIG. 21.—COMPARISON OF RETURN TRIPS, SPECIAL CAR TEST, PIKESVILLE ROAD, JUNE 21, 1893, AND JUNE 8, 1894.
Portions of Figs. 15 and 18 superimposed.

The average speed for the round trip was 20 miles per hour as compared with 18.3 in the first test, and in going out it went as high as 26 miles per hour at one point and several times from 27 to 29 miles per hour on the return trip.

Table III., given on p. 177, contains the principal data and average results of this test.

(*To be continued.*)

A New Conduit Railway System.

We illustrate herewith a new conduit railway system which possesses several points of novelty and ingenuity. The system is being exploited by the La Burt Electric Railway Company, 123 Liberty Street, New York, and is the invention of Mr. John La Burt, the company's engineer. It belongs to that class of conduit railways in which the working conductor is sectional, the sections being connected with the supply mains only when cars are over them. The La Burt system, however, differs radically from others of this general class in that there are no magnetic switches or contact-making devices, the working conductor being put in and out of circuit in the very simple and ingenious manner described below.

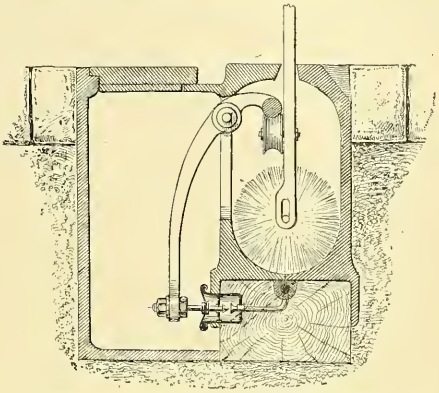
The conduit is located just outside one of the rails and contains only one conductor, the rails being used for the return, as in the trolley system. The conductor, as above stated, is sectional so far as conducting material is concerned, but the ends are mechanically joined by a non-conducting and flexible medium which behaves exactly as a universal joint. Each section of conductor is supported, at the ends only, upon the arms of two bell cranks; the other arms of these carry contact fingers which, when the conductor is raised, complete a connection between the mains and the conductor section which is supported by the crank levers.

The contact device consists of a ⊥-shaped plow which projects downward from the side of the car and carries two grooved wheels, like trolley wheels, on the extremities of its horizontal portion within the conduit. These wheels run *under* the sectional conductor and raise each section of it as they reach that section, completing, by means of the bell crank levers, connection between the sectional conductor and the mains. As the car passes beyond a given section, the contact wheels being no longer beneath it, that section drops down, cutting itself out of circuit.

The sections are made sufficiently long to insure the dropping of one end while the other end is held up, the flexible connections between the individual sections permitting this action. Therefore, as the car comes to a section, only the nearest end of the conductor section is raised, the bell-crank at that end putting it in circuit; when the car is over the middle of the conductor section, the far end will have been raised and an additional contact made there, the conductor section being made of pipe to secure the proper rigidity. As the car moves further and further from the first end of the section, that end sags and finally drops to its lowest position just before the contact wheels reach the far end; as there is a contact at this end, the breaking of contact at the end in the rear of the car produces no spark. In raising the far end of the live section under the car, the near end of the section just beyond is raised, so that when the contact wheels pass from a given section the section beyond is in circuit and ready to supply current. The two wheels of the contact device are placed sufficiently far apart to straddle the break between sections and obviate any sparking there.

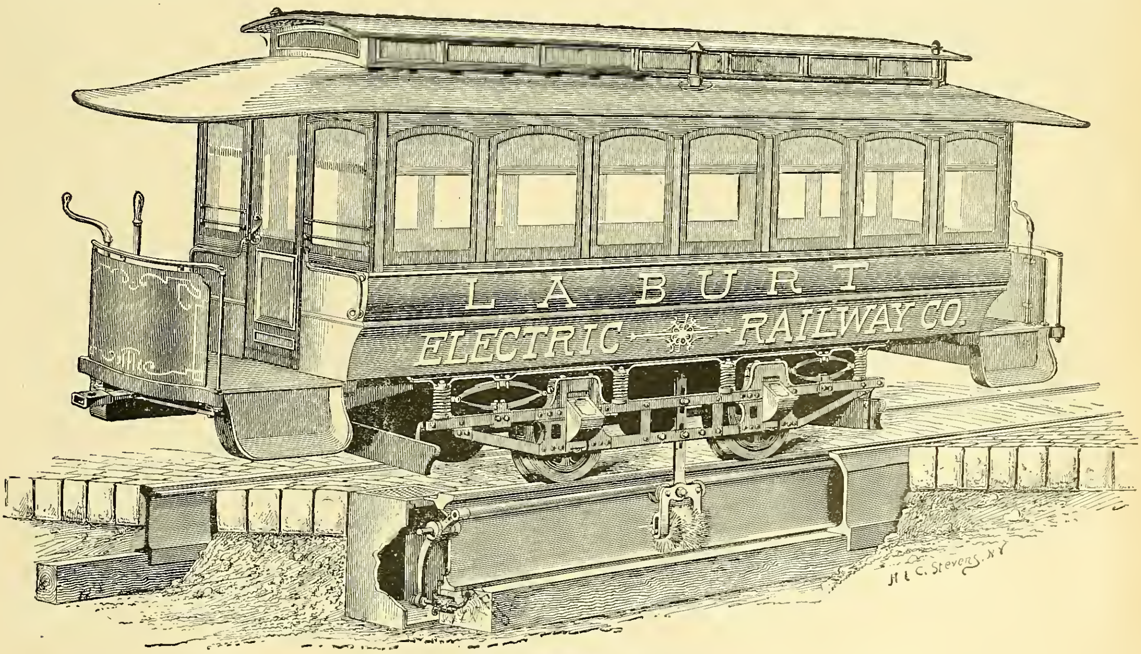
The plow also carries a circular wire brush, as shown in the engravings, which is set at such an angle that the friction against the sides of the conduit causes it to revolve and clean the walls of the conduit as the car passes along.

The contact plow is movable vertically on the car truck, but is normally held up by a strong spring. In the event that it should become desirable to remove the contact wheels from the conductor, the motorman can depress the plow, allowing the sectional conductor to break contact with the mains, and also dropping the contact wheels from the conductor entirely.



SECTIONAL END VIEW AT CONTACT BOX.

At each break in the working conductor, a contact box is located, access to which is readily had by removing the cover, which does not involve the removal of any pavement or the disturbance of the track or conduit structure.


LA BURT
ELECTRIC RAILWAY CO.
H. C. Stevens, N.Y.

THE CAR ON THE TRACK.

The La Burt Company has in operation at its office an interesting model of this system, which plainly shows the action of the cut-out mechanism, etc., and which works without a hitch.

FINANCIAL NOTES.

COTTAGE CITY RAILWAY.—The railway commission has granted permission to the Cottage City Railway Company, Martha's Vineyard, Mass., to increase its capital stock from $25,000 to $40,000.

THE ANN ARBOR RAILWAY.—The Toledo, Ann Arbor & North Michigan Railway has been absorbed by a new company, which has filed articles of association under the name of the Ann Arbor Railway Company. The new company has a capital stock of $7,250,000.

LYNN & BOSTON RAILWAY ACQUIRES THE BOSTON & REVERE COMPANY.—The Lynn & Boston Railway has applied to the railway commissioners for their approval of a lease which the road has made with the Boston & Revere Electric Company for 99 years.

CHESTER, PA.—The directors of the Media, Middletown, Ashton & Chester Electric Company last week voted to increase its capital stock from $30,000 to $150,000. There will be another meeting next week, when the plans for the immediate construction of the road will be completed.

BUFFALO, N. Y.—The stockholders of the Buffalo, North Main Street & Tonawanda Railway Company have filed with the county clerk notice of their consent to mortgage the company's property for $75,000. The money is to be used to cancel a floating debt and to provide for future extensions and additions to the company's equipment.

THE NASSAU ROAD VICTORIOUS.—In the suit of the Nassau Electric Railway Company to enjoin the Long Island Railway Company and the Manhattan Beach Railway Company from interfering with the plaintiff's crossing the Manhattan Beach track at Ocean avenue, Judge Pratt, of the Supreme Court, on Tuesday afternoon granted a temporary injunction.

THE CITIZENS' TRACTION LEASE.—The stockholders of the Citizens' Traction Company, of Pittsburg, will meet on Oct. 7 to ratify the lease to the new company, which has been organized to absorb the principal street railways of that city. The lease is made to the Fort Pitt Traction Company, which offers to pay the Citizens' Company's bonded debt, take care of its floating liabilities, pay its taxes, provide for every item of cost in operating its lines, and pay 6 per cent. on the capital of $3,000,000, or $180,000 annually, to the stockholders.

ALLEY "L'S" AFFAIRS.—It is stated that the Alley L stockholders' reorganization committee will make no attempt to do anything before Oct. 1, but will stand aside and allow the bondholders to institute foreclosure proceedings under their mortgage on that date. Up to last Friday night very close to 30,000 shares of stock had been turned in to Chairman Mitchell, of the committee, and Col. Walcott, of New York, another member of the committee, controls a large block, the amount being variously estimated at from 12,000 to 16,000 shares.

CONSOLIDATION IN WASHINGTON.—It is reported that at a recent meeting of the stockholders of the Washington & Georgetown Railway Company, an agreement was ratified for the consolidation of the road with the suburban electric road to Chevy Chase, Md., under the control of the directors of the Georgetown Company. The capital stock was increased from $500,000 to $12,000,000, and the two consolidated companies became the Capital Traction Company, of Washington. Under its charter the Washington & Georgetown Company was prohibited from increasing its capital stock, but the Chevy Chase road's charter permitted it to increase its capital stock and change its title.

REORGANIZATION OF DELAWARE VALLEY RAILWAY.—The Delaware Valley Electric Railway Company, of Stroudsburg, Pa., has been reorganized. It was decided to change the name from the Delaware Valley Electric Railway Company to the Delaware Valley Railway Company. The amount of capital stock was made $200,000. The president of the new road is Dr. J. H. Shull, and the directors comprise John M. Hill, M. F. Coolbaugh, A. W. Loder, E. F. Peters, J. Ottenheimer, F. W. Rilenberger, T. Y. Hoffmann and Jesse Ransberry. The company has already received offers for and will sell immediately all the personal property belonging to the old company. Negotiations are now pending with New York and Pennsylvania parties for the purchase of all the stock.

RAILWAY MATTERS IN AKRON.—A prominent capitalist and manufacturer of Akron is authority for the report that the management of the Akron Street Railway Company has passed into the hands of W. A. Lynch, of Canton, as trustee for the Manhattan Trust Company, of New York. Rumors of some such condition of affairs have been current for several weeks, but the facts are just becoming public. For the last month a deal has been in progress in the East to consolidate the Akron Street Railway Company, the Akron General Electric Company and the Akron Gas Company, and to bond the consolidated incorporation to the extent of $1,500,000. The street railway company, it is understood, is to go into the deal for $650,000, and its present owners will realize a profit of the difference between its indebtedness and these figures. The aggregate indebtedness of the road is now $485,000, consisting of $300,000 mortgage indebtedness and $185,000 general indebtedness, and the Manhattan Trust Company is custodian of the $300,000 mortgage bonds to prevent the road being forced into the hands of a receiver or assignee by creditors other than the Manhattan Trust Company.

THE GETTYSBURG RAILWAY IN RECEIVERS' HANDS.—Upon a bill in equity filed in Philadelphia by the Maryland Steel Company, Judge Dallas has placed the Gettysburg Electric Railway Company in the hands of receivers. M. Hoffer and the West End Trust & Safe Deposit Company were named as the receivers, and were directed to enter security in the sum of $10,000. The appointments of the receivers by the direction of Judge Dallas are provisionally and temporarily made with leave to any person interested to move the Court for modification thereof or change therein at any time within 30 days from the date of the appointments, and in the absence of any such motion the appointments are to stand as the settled order of the Court. The Maryland Steel Company directs its bill against the Gettysburg Electric Railway Company and the Fidelity Trust & Safe Deposit Company, of Philadelphia, the latter company being the trustee for the bondholders under a mortgage executed by the Gettysburg Company, under which $200,000 bonds were issued. The Maryland Steel Company is the holder of $5,000 worth of these bonds, and it alleges that default has been made in the payment of the coupons of said bonds since Nov. 1, 1893. It is averred that it will become the duty of the trustee to proceed to foreclose the mortgage.

TRACTION EARNINGS.—The average daily gross earnings of the People's Traction Company, of Philadelphia, for the week ended Sept. 21 were $6,285, against $6,626 for the preceding week, and $6,665 for the week ended Sept. 7. This decided drop in earnings is probably due to a falling off in pleasure riding. On last Saturday the company's receipts were $8,167, an increase of $2.492; on Sunday they were $7,741, or $2,045 greater than for the corresponding day last year. The earnings for the Hestonville system for the third week in September were $9,960, of which $8,174 came from the Arch Street line and $1,785 from the Race Street line. The returns from the former show an increase of $3,685 and from the latter $1,102, making a total increase of $4,788 This increase is nearly 100 per cent., and yet the comparison is not considered a fair one, for the reason that a year ago the Hestonville system was in a demoralized condition, owing to the change then being made in its motive power. Carrying the comparison back to 1893, in which year the company's largest earnings were made, the present earnings are averaging 50 per cent. greater than then. The report of the Brooklyn Traction Company for the month of August shows gross earnings of $117,288, a decrease of $5,768; operating expenses, $63,753, an increase of $2,039, and net earnings, $53,534, an increase of $3,729.

WEST END STREET RAILWAY EARNINGS.—The gross passenger receipts of the West End Street Railway Company, of Boston, for the first 11 months of its present fiscal year, and the estimate for September and the fiscal year ending Sept. 30, make the following showing:

	1894-5.	Increase.
October	$645,000	$73,000
November	589,000	55,000
December	591,000	73,000
January	556,000	61,000
February	492,000	55,000
March	569,000	37,000
April	595,000	63,000
May	671,000	71,000
June	713,000	68,000
July	747,000	110,000
August	738,000	135,000
September (estimated)	690,000	75,000
Total	$7,596,000	$876,000
Add increase for advertising lease		16,000
Gross increase of revenue		$892,000

When the returns are all in it is thought that the gross increase may be as high as $900,000 for the year, and the common stockholders will have received 6½ per cent. instead of 7½ per cent., as last year, which is a withholding of about $90,000. Operating expenses proper are less than 66 per cent., whatever may be put in additional in making up the annual report. The estimate for the year follows:

Gross receipts, 1894-95		$7,596,000
Operating expenses, actual maximum at 66 per cent		5,013,360
Net earnings		$2,582,640
Deduct taxes	$280,167	
Coupon interest	370,959	
Rentals of leased roads	11,897	
Preferred dividends	512,000	
		1,175,023
Net for common stock		1,407,615
Deduct for track renewals and excessive "charging off"		500,000
Leaving for common stock (10 per cent.)		907,615

NEW INCORPORATIONS.

THE ULSTER COUNTY ELECTRIC RAILWAY COMPANY, Kingston, N. Y., capital stock $100,000, has been formed for the purpose of building and operating an electric street railway. The promoters are C. A. Johnson, W. T. Tiers, F. H. Reed, G. N. Kibbin, all of New York City.

THE NORTH NEW YORK CITY TRACTION COMPANY, New York City, N. Y., capital stock $210,000, has been formed to build and operate a street surface road in New York City. The promoters are Henry Seibert, J. H. Haskin, W. T. Ryan and E. J Goldrick, New York City.

THE TOLEDO & POUGHKEEPSIE ELECTRIC RAILWAY COMPANY, capital stock $200,000, has been incorporated to build and operate an electric railway from West Toledo, O., to Petersburgh, Mich. Incorporators, John O. Zabel, Winfield S. Coon, Willis Baldwin, Geo. F. Wells and Clyde E. Coon.

THE COLUMBUS SCENIC RAILWAY COMPANY, Cincinnati, O., has been organized for the purpose of building and operating scenic railways, operating pleasure parks, halls, etc. The promoters are John J. Shipherd, M. H Solloway, W. E. Hutton, J. M. Hutton, W. D. Hutton. Capital stock $15,000.

THE NEVADA ELECTRIC RAILWAY, LIGHT & PARK COMPANY, Nevada, Mo., has been organized for the purpose of operating street railways and for furnishing electric light, heat and power. The incorporators are H. C. Moore, C. E. Strohm, Nevada, Mo., and G. W. Dudley, Upper Alton, Ill. Capital stock $130,000.

THE GALLIPOLIS & POINT PLEASANT RAILWAY COMPANY, capital stock $50,000, has been incorporated at Gallipolis, O., to build and operate an electric railway between Gallipolis and the K. & M. Ry. bridge over the Ohio River. The promoters are John L. Vance, H. C. Johnston, L. E. Jones, Lawrence H. Cott and C. R. Duffey.

THE FORT WAYNE & HICKSVILLE ELECTRIC RAILWAY COMPANY, Fort Wayne, Ind., has been organized to construct, own and operate a street railway in Fort Wayne. Among those interested are John S. Hart, Hicksville, O.; James B. Colgrove, Washington, D. C.; John W. Winn, Defiance, O.; Aaron M. Richelderfer, Harlan, Ind. Capital stock $50,000.

THE HUNTINGTON, COLUMBIA CITY & LIGONIER ELECTRIC RAILWAY COMPANY, Columbia City, Ind., has been organized to construct, maintain and operate electric railways in the cities of Huntington, Columbia City, Albion and Ligonier. Those interested are Vallorous Browr, George W. Ruch, Joseph H. Ruch, Thomas R. Marshall and William F. McNagny. Capital stock $50,000.

THE UNION TRACTION COMPANY OF PHILADELPHIA, Philadelphia, Pa., has been formed for the purpose of building and operating street railways, to be operated by electricity or cable power. The incorporators are James McNanes, Peter A. B. Widener, William L. Elkins, Thomas Dolan, George D. Widener, Jeremiah J. Sullivan, Alfred Smith, Alex. M. Fox, John Lowber Welsh, William H. Shelmerdine, Caleb F. Fox, Philadelphia, Pa. Capital stock $100,000.

NEWS OF THE WEEK.

SUFFOLK, VA.—It is proposed to build an electric road between Suffolk and Smithfield.

PARIS, TEX.—An electric street railway, connecting West Paris with Paris, is said to be assured.

CLEVELAND, O.—The Cleveland Electric Railway Company has been granted a franchise to extend its tracks in the South End.

MADISON, ME.—The work of grading for the electric road is nearly completed and track construction will probably begin next month.

PARKERSBURG, W.VA.—The Parkersburg Council has given the American Construction Company another franchise for a street railway.

MIDDLETOWN, CONN.—The Westport & Naugatuck Railway Company and the Norwalk Street Railway Company have filed an acceptance of their charters.

ERIE, PA.—An electric road on Parade Street, through Wesleyville to the Four Mile Creek, is talked of. Councilman Edward Mehler can probably give information.

TACOMA, WASH.—Architect John D. Proctor has finished plans for remodeling and rebuilding the power-house of the Tacoma Railway & Motor Company. About $10,000 will be expended.

RICHMOND, S. I., N. Y.—The Richmond County Board of Supervisors have accepted bonds of the Midland Railway Company, and work will be begun to lay new rails for the electric line at once.

CHICAGO, ILL.—The Chicago Northern Pacific Railway Company will let the contracts for changing the line into an electric road within the next 30 days. It is supposed that the electric system will be in operation by Nov. 15 or Dec. 1.

LIMA, O.—Right of way has nearly all been secured for the Lima & Piqua Railway, which will connect with Wapakoneta, St. Mary's and other places. A belt line will also be put around the city which will do both a passenger and freight business.

COLUMBUS, O.—The Columbus Central Street Railway Company has asked permission to put a double track on Spruce Street, between Park Street and City Avenue The first petition signed by the property owners specified a single track, but they have since signed for a double track.

PHILADELPHIA, PA.—The foundry building at the southeast corner of Fifteenth and Hamilton Streets, a portion of the Baldwin Locomotive Works, is being torn down, and a new structure will be built on the site for use as a fitting and equipment shop for the new electrical department.

ELYRIA, O.—The City Council has granted a franchise to James L. Mauldin, of Cleveland, representing a large construction company, to build an electric railway from the south to the north limits of this city, from which an extension will be made to Lorain, making the second interurban line here.

JALAPA, MEX.—The first electric railway in Mexico is soon to be in operation in the State of Vera Cruz. It will run from this city to Orizaba, a distance of about 90 miles, passing through Coatepecjico and other towns in the rich coffee district of the State. Gen. Frisbee is the owner of the concession for the road.

NEW HAVEN, CONN.—The Middletown Street Railway Company, of which Israel Kelsey, of West Haven, is a leading official, has obtained permission to extend its lines to Cromwell, and work of construction will be started at once. The extension is to be three miles long and about $40,000 will be expended on the work.

LANSDOWNE, PA.—Application has been made to Lansdowne Borough Council for right of way through several streets for a trolley line, to be known as the Suburban Railway Company. The road is to be built from Philadelphia to West Chester, through Cardington, along the Marshall roads, then along Darby Creek to Tuscarora and Heyville and on to West Chester.

KANSAS CITY, MO.—Plans to build the proposed Eighth Street "L" road will soon be revived by the introduction of an ordinance in the City Council. granting the Metropolitan Street Railway Company a franchise to construct it. Should the privilege be granted the company will build a surface line from Grand Avenue to Walnut Street, and thence across the proposed viaduct to Wall Street.

PHILADELPHIA, PA.—The trolley ordinance of the Grand Boulevard Street Railway Company came up before the Council's street railway committee last week and was referred to a sub-committee for investigation. The bill authorizing the Lehigh Avenue Passenger Railway Company to lay a double track on Glenwood avenue, from Seventeenth street to Lamb Tavern road, was also referred to a sub-committee.

MILFORD, MASS.—A conference has been held between the Milford & Hopedale Street Railway Company and the New Milford & Framingham Company, and as a result the franchise, rails, etc., of the former company were purchased by the new company, the contract covering everything belonging to the Hopedale Company, except the cars and buildings. It is expected that work will be commenced on the new road at once.

FRANKFORT, KY.—By an order of the United States Court in Louisville, Judge Barr presiding, the Capital Street Railway Company, of this city, will be placed in the hands of George B. Harper, as receiver. The order was issued on motion of the attorney representing the New York Security & Trust Company, in its suit against the Capital Railway Company. The trust company was the trustee of the bonds of the railway company.

BAY CITY, MICH.—E. K. Mussey and P. Parks, of Elyria, O., contemplate the construction of an electric road between this city and Saginaw and have conferred with the managers of the Bay City Consolidated Street Railway concerning the use of the company's tracks when the new road reaches this city. An offer of $5,000, it is said, will be made by the capitalists for the privilege of building a viaduct over the F. & P. M. tracks. They claim the new road will be constructed as soon as arrangements can be made between the two cities.

FLUSHING, L. I.—The Brooklyn City Railway will probably be extended to this village without delay. William L. Cornell, secretary of the Board of Highway Commissioners, has received a check for $2,500 from Clinton T. Rossiter, president of the company, in payment of the railway's share of the expense of repairing that part of Strong's Causeway which is located in the town of Flushing, in accordance with the terms of the franchise. A similar check will be forwarded to the Newtown highway commissioners as soon as the work on the causeway is completed in that town. The line has had cars running to Corona for some time and to reach this village only a short extension will be necessary.

CHICAGO.—An electric trolley line offering quick service and cheap transportation from Chicago to the lake region north is proposed by the Chicago & Wisconsin Inland Lakes Company, which has just been incorporated by Chicago capitalists under the laws of Wisconsin. Survey of the route will begin at an early date, and if the company's plans materialize, the road will be ready for service by the opening of the lake resorts next Summer. The route of the line is not as yet specifically laid down, but it is proposed to run from some central point in Chicago to Madison, Wis., with branch lines to all the intermediate lake resorts. If found advisable a line will be run also to Milwaukee,- and the entire system further extended.

NEW ORLEANS, LA.—THE ELECTRIC RAILWAY GAZETTE of Sept. 14 contained in this column a paragraph taken from a daily paper, in which it was stated that the linemen of the New Orleans Traction Company had struck a few days before because one of their number had been discharged, and intimated that they had tried to induce motormen and conductors to leave their positions. Mr. W. Nelson Smith, electrical engineer of the New Orleans Traction Company, writes us that this report was without foundation, and that, on the contrary, "when a strike of conductors and motormen seemed imminent last Winter, and again during the past Summer, the linemen rejected all advances from the labor agitators, and declared their intention of standing by the company."

STONEHAM, MASS.—An electric street railway between Winchester and Stoneham is to be constructed. The proposed Mystic Valley street railway has been taken hold of by the owners of the Wakefield & Stoneham road, and the new line from Stoneham to Winchester will be built and operated under that control. The distance between the towns is less than three miles, and the running time of the electric cars will be less than that of accommodation passenger trains. The capital stock of the proposed road is $40,000. Among the subscribers to large amounts are Charles F. Woodward, Wakefield; James F. Shaw, Newburyport; Onslow Gilmore, Stoneham; Samuel W. McCall, Abraham B. Coffin, Louis Goddu, Frank W. Winn, Winchester. It was proposed to build the road to Arlington, but, owing to opposition on the part of residents on the west side of Winchester, the scheme was abandoned.

PERSONAL NOTES.

MR. AXEL H. ENGSTROM has been appointed chief engineer of the Electric Traction Company of Philadelphia to succeed Major Edward B. Ives, who has accepted the position of chief engineer of the Allentown & Reading Electric Railway Company.

MR. H. WARD LEONARD was married at Geneva, Switzerland, on Aug. 24, to Miss Carolyn Good. Mr. Leonard's friends are legion and his popularity unsurpassed in electrical circles, and the good wishes that go out to him are as sincere and hearty as they are numerous.

MR. FRANK JUDSON POPE, son of Mr. Ralph W. Pope, secretary of the American Institute of Electrical Engineers, has entered the field of daily journalism on the staff of the *Evening Sun*. Mr. Pope, who graduated from Columbia College in the Class of '95, is well equipped for the profession he has adopted, not only intellectually, but in the possession of personal qualities that will commend him to those with whom he comes in contact.

MISCELLANEOUS NOTES.

MR. HERBERT T. RICHARDS, who is well known and popular in electrical circles, recently accepted a position with The Safety Insulated Wire & Cable Company. Mr. Richards' many friends will join in wishing him success in his new field of labor.

FLEXIBLE MICA PATENTS ALLOWED.—The board of appeals of the United States Patent Office has just reversed the decision of the primary examiner, and granted the right to protection upon what is known to the trade as "flexible mica," an insulation recently introduced by the Mica Insulator Company, of 213 Water Street.

TRADE NOTES

THE BUCKEYE ELECTRIC COMPANY, of Cleveland, O., has just issued one of the most artistic catalogues ever presented to the trade. Each page not only contains a well-executed cut of a certain style of lamp, but is embellished with unique etchings of designs appropriate to the style of lamp on that page. The book is thoroughly original and reflects the progressive policy and good taste of its publishers.

THE J. H. M'EWEN MANUFACTURING COMPANY, builder of high-grade automatic engines, has opened an office at 1208 Havemeyer Building, in order to facilitate the handling of its greatly increased business in this vicinity.

HUNT INDUSTRIAL RAILWAYS are coming more and more into favor as their advantages are made evident. The Ansonia Brass & Copper Company, Ansonia, Conn., now uses Industrial railways of 21½ inches gauge, designed by the C. W. Hunt Company, of 45 Broadway, and the Thorndike Company, Thorndike, Mass., has also installed the Hunt system of narrow-gauge railways for handling materials in its works.

THE PUMPELLY-SORLEY STORAGE BATTERY COMPANY, of Chicago, has recently closed a contract with the St. Joseph & Benton Harbor Electric Railway Company, St. Joseph, Mich., for 240 100 ampere-hour accumulator cells to be used as an auxiliary in that company's railway and lighting station. This, it is said, will be the first installation of accumulators in conjunction with a railway plant that has ever been established in the United States.

THE PEERLESS RUBBER MANUFACTURING COMPANY, of 16 Warren Street, New York, has just received the following letter from Chief Engineer Henry J. Reynolds, of the steamship *North Land*, of which President Dale is justly proud: "I have used 'Rainbow' packing for steam and hot water pressures of 266 pounds and 500 to 600 pounds, respectively, and find it superior to all others. Before using Rainbow I tried various other packings, and found that they would not hold. I therefore tried 'Rainbow' packing, and can cheerfully recommend it as being the only packing for all high pressures in the market to-day." Thus does "Rainbow" packing continue to add to its already enviable record.

THE METROPOLITAN ELECTRIC COMPANY, of Chicago, reports heavy sales recently of "P. & B." tape, for which this wide-awake concern is Western agent. All imitations of "P. & B." goods, says the Metropolitan Company, have proven inferior, the "P. & B." still holding its old-time record of superiority. The Metropolitan Company states that the delivery of its new catalogue has been delayed on account of additional matter that has come up, and which will increase the book to 700 pages. This edition will be a huge one and, it is claimed, the largest and most complete electrical catalogue in the world. It is now expected that the book will be ready for distribution by Oct. 1, and its appearance will be eagerly watched for by the trade generally.

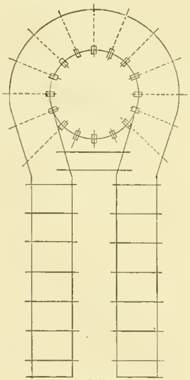
EUGENE MUNSELL & CO., 218 Water Street, New York, are sending out to the trade an attractive reminder in the shape of a commutator-insulating segment stamped from solid sheet mica, and provided with a brass loop for hanging up the segment, which the recipient is requested, by a legend printed in gilt on the mica, to do. The suggestion does not stop here, however, but continues: "and when you need stamped solid sheet mica segments send to Eugene Munsell & Co.," giving the address. This enterprising concern has met with such signal success in the production of high-grade mica for electrical purposes that it has been compelled by sheer volume of actual business to add 2,600 square feet to the factory and put in three new presses. A most complete stock of mica is carried constantly on hand so as to enable the firm to fill orders promptly.

THE TANDEM BRAKE COMPANY, Havemeyer Building, 26 Cortlandt Street, New York, has issued a very handsome catalogue illustrating and describing the tandem car brake. In it managers of railway companies are advised to "break away from the old idea" and use "the best brake in the world for electric, cable or steam cars." It is claimed that the tandem brake, which can be applied by air or electricity, combines the ease of application of both the air and the electric brake; only requires one hand to operate, and can be depended upon under all conditions; will hold the car on grades, and, when the rail is bad, "giving the motorman a living chance to save the people's lives and the stockholders' dividends." All interested in brakes should write for a copy of the new catalogue. Mr. Edward B. Wyman, general manager of the Tandem Brake Company, and well known to street railway managers, will be pleased to furnish full particulars to intending purchasers, either by mail or when he sees them at Montreal.

Record of Electric Railway Patents.

UNITED STATES PATENTS, ISSUED SEPTEMBER 17, 1895.

546,303. TROLLEY POLE FOR RAILWAY CARS; Robert Crommer, Philadelphia, Pa., assignor of one half to James Stewart, Jr., same place. Filed Jan. 29, 1895. The pivotal rod is provided with a bracket, which carries a trolley wheel upon its outer end. A sleeve is secured to the trolley by means of a lug, slot and channel.



No. 546,305.—RAIL.

546,305. RAIL; James Davis and William A. Thomas, Pittsburg, Pa. Filed Dec. 26, 1894. This is a rail designed for use on loops or curves The rail is mounted on a series of rolls which have straight or beveled flanges in combination with chairs and castings, extending slightly above the level of the rail. (See Illustration.)

546,387. HOSE BRIDGE; Isaac Niskern, Milwaukee, Wis., assignor of one half to James B. Hatch, same place. Filed Feb. 18, 1895. The bridge comprises blocks having clamp jaws that come inside of track rails when the blocks are in place thereon. A brace is connected at its extremities to the blocks so as to bear against the jaws, and is provided with an intermediate extensible joint, the bridge rails being joined to the blocks.

546,389. UNDERGROUND CONDUIT FOR ELECTRIC RAILWAYS; Herluf A. F. Petersen, Milwaukee, Wis. Filed March 19. 1894. There is a plurality of underground conduits for electric conductors and suitable means are provided for establishing continuous communication between a desired pair of the ends of these conduits, so that the conductor sections may be brought into register with the conductors of a desired conduit. Suitable electrically actuated mechanism is operatively connected with the adjustable conduit section and is adapted to adjust the same into a desired position. The switch mechanism starts, stops and reverses the adjusting mechanism and is adapted for operative engagement with the adjustable conduit section.

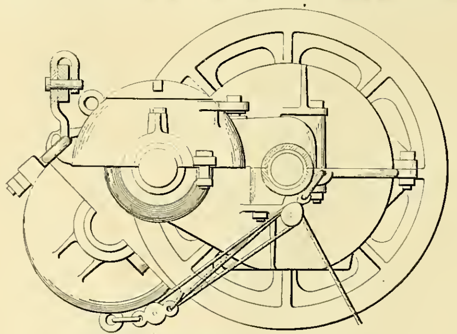
546,407. TROLLEY WIRE BRACKET; Leroy S. Pfouts, Canton, Ohio. Filed Oct. 20, 1894. An arched arm is supported at right angles to the trolley wire by an arm secured to the pole. Springs are attached to the arched arm and a trolley wire clamp is located below this arm.

546,510. AIR BRAKE FOR RAILWAY CARS; Dennis Dunn, Mahanoy City, assignor of forty-nine one hundredths to John E. Reyburn, Philadelphia, Pa. Filed Dec. 21, 1894. An air compressor has its piston connected with a rotatable axle, and a separate cylinder having at one end an inlet pipe leads from the compressor. There is an air opening in its opposite end and a piston in the cylinder is connected with a brake mechanism. A pipe leads from the inlet pipe end of the cylinder to a whistle, and there is a three-way cock in the pipe. The casing of the cock has an outlet to the atmosphere.

546,524. CAR FENDER; John F. Girtler, Brooklyn, N. Y., assignor to himself and Gaston E. Constantin, Adolf Glaus and Friedrich Heinemann, same place. Filed June 5, 1895. The fender comprises a frame adapted to be hung on a support on the car, and a platform is pivoted on the lower end of the frame. A tripping plate on the front end of the platform normally extends vertically. The platform is spring-pressed and is provided with a hook, A guard rail is pivoted on the platform and extends on the sides thereof and across the front, the front end of the guard rail being normally engaged by the hook.

546,546. ELECTRIC RAILWAY; Harry M. Montgomery, New York, N. Y., assignor by mesne assignments to Leon Dion, Boston, Mass. Filed June 14, 1892. This is the combination with a continuous supply conductor of a sectional working conductor and an intermediate auxiliary conductor formed of a continuous series of smaller magnetic parts, interlinked and in electrical contact with each other for connecting the supply conductor with the sections of the working conductors.

546,560. ELECTRIC LOCOMOTIVE; Sidney H. Short, Cleveland. O. Filed April 23, 1894. An electric motor is journaled in the free ends of a frame mounted on its outer end on the driving axle, and gearing connects the motor and axle. A cross bar is supported at its opposite ends by the side bars of the truck frame. Springs are interposed beyond the cross bar and side bars, and a swinging link connects one side of the motor casing with the cross bar. (See Illustration.)



No. 546,560.—ELECTRIC LOCOMOTIVE.

Electric Railway Gazette.

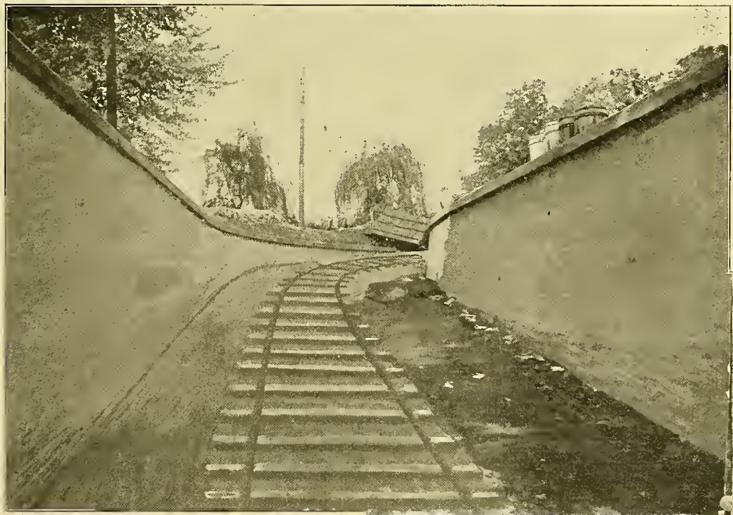
Vol. XIII. NEW YORK, OCTOBER 5, 1895. No 14.

The South Orange & Maplewood Railway.

One of the most interesting suburban electric roads in New Jersey is the South Orange & Maplewood Railway, now in course of construction. The notable features of the work are the solid construction of the road and the excellence of the material used, while the greatest pains have been taken to make the line as nearly perfect as possible. In the construction of the roadbed steam railway practice has been closely followed throughout.

The line extends through one of the most picturesque parts of the Oranges, and it will afford the first direct railway communication with the grounds of the South Orange Field Club, the popular athletic headquarters.

The section of the road extending from the D., L. & W. R R. station in South Orange to the lower terminus of the Orange Mountain Cable Railway is about completed, and will be in operation in a few days. The entire route lies along the banks of the east branch of the Rahway River, and the ride from South Orange will be through a veritable park over its entire length. Trees will be planted along the line and every effort will be made to make the road as attractive as possible. The company intends to run its cars at a high rate of speed, and the roadbed has been constructed throughout with this object in view.

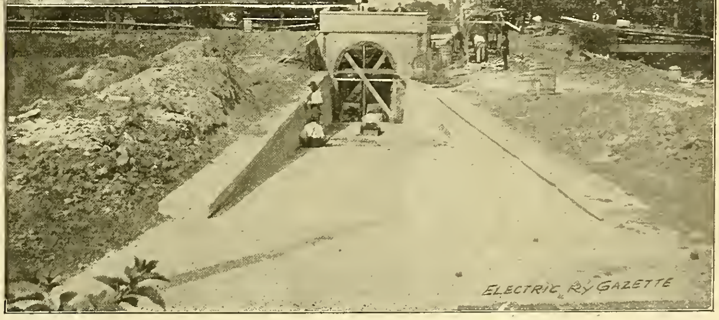


NORTH APPROACH OF TUNNEL.

The track is laid with T-rail with the exception of a section of about 400 feet in length on South Orange Avenue, on which 9-inch Johnson girder rail is employed. The T-rails were supplied by the Johnson Company and weigh 56 pounds to the yard. They are spiked to oak and chestnut ties placed two feet between centres. Six-bolt fish-plates are employed, and the rails are double bonded with No. 0000 copper wire. The bonds are 8½ inches in length and are riveted through the flanges of the rail instead of the web. Cross bond wires are located every 500 feet. The roadbed has an average elevation of about 2½ feet, and is ballasted throughout with six inches of 2½-inch broken stone, which extends 18 inches on each side of the track. The road is practically level throughout its entire length.

As the company owns the right of way the tracks on all curves are super-elevated, which admits of a higher rate of speed than would be possible on streets where the rails must be laid to conform to the grade and consequently cannot be elevated as in steam railway practice. A view of a reverse curve of 100 feet and 150 feet radius at Morris Street is shown in one of the illustrations.

An interesting feature of the road is a tunnel under Montrose Avenue, which was built by the company at a cost of about $16,000. The tunnel is constructed entirely of concrete and is said to be one of the largest pieces of concrete work in the country. The tunnel proper is 50 feet in length and is 14 feet 9 inches in the clear, with a width of 12 feet. In constructing the floor of the tunnel three-inch planks were laid first,



CONCRETE TUNNEL UNDER MONTROSE AVENUE.

and on these were placed fifteen inches of concrete. There are two approaches to the tunnel, also of concrete. The north approach, shown in one of the illustrations, is 100 feet in length, with a grade of 8½ per cent. At the end of the approach is a spiral curve of 60 feet radius. The south approach is 150 feet in length, with a grade of six per cent. The abutments are three feet in thickness, and only the best quality of Portland cement was used.

REVERSE CURVE AT MORRIS STREET.

The beds of the approaches are laid with 12 inches of concrete, and the retaining walls, which are also concrete, extend to the level of the ground. The road through the tunnel is single-tracked, with diamond turnouts and automatic switches at each end. Automatic signals will also be placed at each end of the single-track section, which will enable the motormen to tell at a glance whether the track is clear or another car is in the tunnel.

An ingenious arrangement will be used to keep the beds of the tunnel free from surface water. The apparatus will be entirely automatic, and will consist of a Hall centrifugal pump of a capacity of 1,200 gallons per hour, directly connected to an electric motor which will be operated by the trolley current. From the side of the street stairways will lead to the bottom of the tunnel where the cars will stop to take on and let off passengers.

The road crosses the east branch of the Rahway River at two points, at one of which the stream was diverted from its original course for a distance of over 1,000 feet. At several points along the line the course of the stream has been straightened and ample protection is afforded by timber walls, making an overflow almost impossible, and obviating the danger of possible washouts as well as aiding in the drainage of the property along the banks in the immediate vicinity.

Culverts and drains have been provided at necessary points to drain the tracks and also to provide free passage for the surface water of the surrounding country.

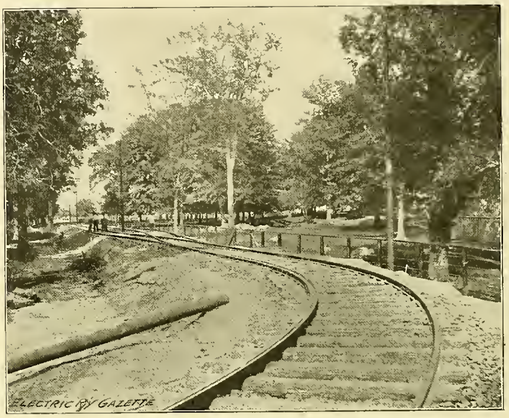
The overhead construction throughout is of a very substantial character. Iron centre poles, supplied by the National Tube Works, are employed, except on curves, where iron side poles are used. Craighead flexible brackets are employed and the trolley wire was furnished by the Ohio Brass Company.

The cars were built by the J. G. Brill Company and are particularly attractive. The bodies are 18 feet in length and are mounted on Brill trucks. They are equipped with General Electric motors and K2 controllers. The heaters were supplied by the Consolidated Car Heating Company. The interiors are finished in hard wood and are very tastefully decorated. The fare registers will be of the Sterling type.

One of the most important features of the line is the fact that it will be operated through a part of West Orange and South Orange that has heretofore been regarded with little favor as a residence district although one of the most attractive localities in the Orange Valley. As a feeder to the Orange Mountain cable road the electric line will tend to advance property on the top of the mountain.

Power for operating the road will be furnished, for the present, by the Suburban Traction Company, but the company will shortly build its own power plant and car-house.

The officers of the company are Frank Brewer, president; Wm. H. Hains, secretary and treasurer; Chas. E. Souther, attorney, and C. W. Bryden, chief engineer; F. B. Freeman has charge of the construction of the tunnel, and the electric and track work has been built under the direction of F. V. L. Turner.



SPIRAL CURVE AT TUNNEL APPROACH.

Preventing Electrolysis.

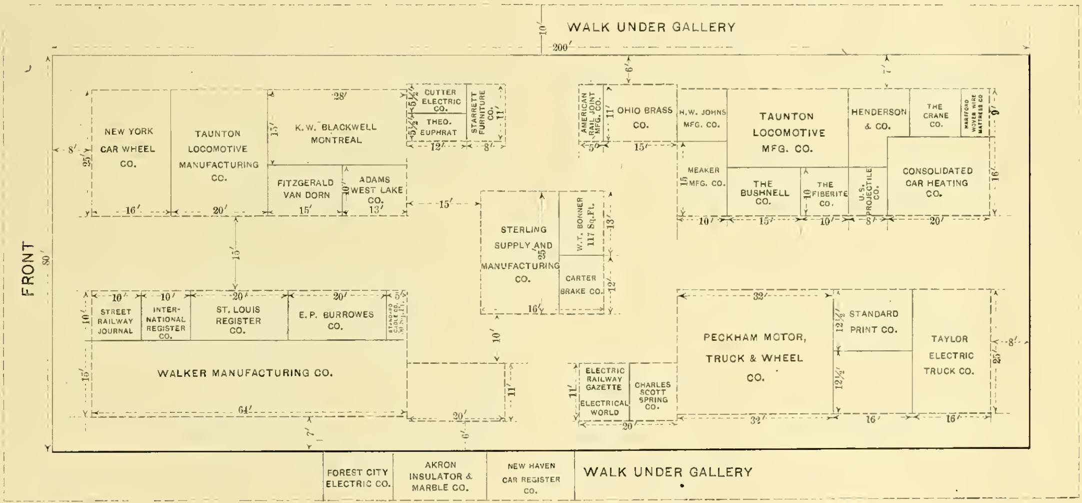
In an article on "Preventing Electrolysis," in *Cassier's Magazine*, Harold P. Brown writes: "I fully agree with Mr. Edison in stating that I know of but one practical method of stopping the destruction of the pipes; fortunately, this, at the same time, effects a large saving of power to the railway company adopting it, for, of course, the work expended in reaching, corroding and leaving the pipes is entirely lost. This is the process used by the board of street and water commissioners at Newark, N. J. The outgoing or positive current is carried to the trolley wire as before, but the negative terminal of one dynamo is disconnected from the rail return wire and joined to a wire leading to the points on the pipes, which suffer the greatest amount of corrosion. The electrical pressure of this dynamo is then increased until the pipes are made two or three volts negative to the rails at the points which were previously positive and were therefore corroded. As long as the pipes are kept negative to the rails, there can be no more corrosion of the pipes and the problem is solved. There is no difficulty in keeping the two sets of dynamos at just the proper difference of pressure to secure this result, and the railways would be eager enough to do this if they realized that their station load could thus be reduced about 20 per cent."

Electricity for Steam Lines.

Speaking of the substitution of electric motors for locomotives on steam railways, General Manager Earling, of the Chicago, Milwaukee & St. Paul, recently said: "There is no doubt in my mind that electricity will eventually replace steam on all railways, but the displacement will be slow, and it may be years before it will come around. At present the trolley is an obstacle in the way of the progress of electricity, and up to date I have heard of nothing that takes its place. To warrant any road in substituting electricity for steam the traffic must be sufficiently heavy to justify the construction of immense power plants—which it would not pay to build to operate a line running only a few trains a day. At present the St. Paul company is not contemplating the electrical equipment of any of its lines."

Street Railway Exhibit at Montreal.

The exhibition of street railway apparatus and supplies at the Montreal Convention of the American Street Railway Convention will be made at the Victoria Rink. The location is in every respect desirable, as it is but a short distance from the Windsor Hotel, where the Association will make its headquarters and where the sessions of the convention will be held. The hall is amply large for the purpose and the Montreal committee in charge expects that a fine showing will be made. It will be seen from the accompanying plan of the hall indicating the space which has been reserved, that an exhibit of merit is already guaranteed. It is expected, however, that the list of exhibitors will be materially increased by the time the convention is opened.



Electric Railway Gazette

PLAN OF EXHIBIT HALL AT MONTREAL.

Car Barn Burned in New Orleans.

A car barn belonging to the New Orleans Traction Company was destroyed by fire on Monday last. The structure was used for storing the old cars which were in use before the trolley system was introduced. Over 100 cars were burned, and the loss will amount to several thousand dollars.

Electric Motors.

It is very often the case that an electric railway superintendent has occasion to use an electric motor for power purposes aside from propelling railway cars. It may be that he has a complicated track crossing to lay at some distant point where a motor driving a small drill press and one or two machine tools would prove of great convenience; or, again, the engine at the station may be required to be turned slowly and steadily for the purpose of truing the commutator, or perhaps Mr. So and So, a friend of the company's officials, wants to know "if you can put in a small motor for him when he shifts his engine or makes a change in his boiler plant." While it is seldom that these stationary motors are permanent, yet for the short time they are required they are very necessary, and the railway superintendent is strongly inclined to look around to see what he actually possesses before he considers what he may borrow or buy.

The first question that usually presents itself is: "How would an ordinary street car motor do? We have plenty of these, and if we can make one of them do somehow, if only for a few days, we shall be out of our difficulty." When the attempt is made to use an ordinary railway motor for such purposes, it is usually found that while plenty of power is available, it is most ungovernable. For instance, if a railway motor is set on a flat car and belted to a few machine tools, for the purpose of track construction or repair, the operator will find that as long as he keeps the load constant the motor behaves very nicely. However, let him take a lighter chip or ease up on the pressure of his drill, or, worst of all, throw his shipper, and the motor will at once begin to race at a speed totally unfit for the work that it is required to do.

Where the load is very light, and therefore next to none at all, the motor may be controlled by a resistance, and be very satisfactory, for any change of load must be practically negligible, but running at such light loads any motor must be very inefficient. Therefore for running a single drill press or lathe, or turning over a directly coupled unit very slowly for the purpose of truing the commutator, an ordinary car motor with a simple resistance will do, but for running a machine shop or any work where it is liable to be loaded to its full capacity, and then again at no load at all, the speed will be so variable that very radical modifications must be made or a different motor adopted.

The speed of any direct-current motor depends almost exactly upon the following equation: $S = \frac{E}{N F K}$ where S equals the speed, F the flux of magnetic lines, E the impressed E. M. F., N the number of conductors counted around the armature, and K a constant quantity. We desire a constant speed for this particular service, hence, we must make every factor of the term $\frac{E}{N F K}$ a constant quantity. Taking up these factors separately, we have, E is constant, because in any modern electric railway system it is so maintained. N the number of conductors on the armature is constant for any one motor. K is constant by hypothesis, and it therefore remains to make F constant, and the desired result will be accomplished.

The field magnet and armature of a railway motor are always connected in series, and it will be impossible to accomplish constant speed while they remain so connected. As the load of the motor varies, the watts supplied to the motor must also vary, and can only do so through the current factor. The field magnets receiving this variable current must produce a variable strength of field, and the motor will run fast or slow in accordance therewith.

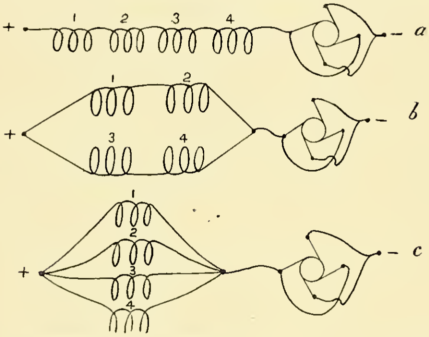


FIG. 1.—METHODS OF CONNECTION OF RAILWAY MOTORS.

In order to get a constant flux of force we must have a constant current exciting the field. The ordinary street railway motor is connected in one of the ways shown in Fig. 1. To get a constant current through the fields we must connect them to the source of supply independently of the armature. But in doing this we must take particular notice of one fact. Series coils in dynamo-electric machines are always of very low resistance; therefore, it will never do to subject the field coils to the full 500 volts, for they are of such a low resistance that an enormous current would flow. Nor is it desirable to use the 500-volt current at all, unless in some way we can use it more economically. If the field bobbins are connected as in *b*, Fig. 1, they may be reconnected in series, and the resistance of the field will then be quadrupled. If they are connected as in *c*, Fig. 1, the series method of connection will increase the resistance of the field to eight times its former value. Thus connected the field magnets will be able much more economically to use 500-volt current, but even then some external resistance must be used to keep down an excessive flow. Car heaters, connected in series or multiple, as may be required, will be found very convenient for this purpose.

It is very often the case in small plants that the lighting and railway station are combined in one. In such an event 110-volt direct current is usually available, and if this may be used for exciting fields, little or no external resistance will be required, especially in the case of *c*, Fig. 1.

If the several railway motors are to be thus transformed, the field magnets of them all may be connected in series, thus making a circuit of comparatively large resistance, and being a working circuit, it will economically use a high-voltage current. It is seldom, however, that more than one motor is desired.

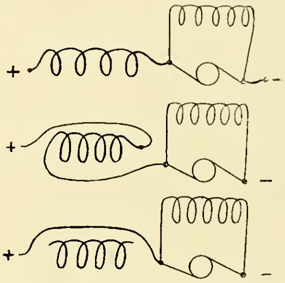


FIG 2.—METHODS OF CONNECTING A RAILWAY GENERATOR FOR MOTOR PURPOSES.

Sometimes a small railway generator is to be had for motor purposes. This transformation leaves nothing to be desired, for it will work efficiently as a motor, but at a somewhat slower speed. If it makes no difference if the speed varies somewhat, it is well to have the series coil of the motor connected in such a way as to assist the shunt coil. To do this the terminals of the coil must be reversed from the positions they occupy when working as a generator. Such motors are much used in hoisting and are called cumulative motors. Cutting out the series field altogether increases the speed of the motor above that of a cumulative connection and gives very satisfactory results where a fairly constant speed is required. Where it is very important that the speed shall not vary the series coils should be left as connected for dynamo purposes. This forms the differential winding. By placing a small resistance across the points B and C in Fig. 3, the portion of the current in the series coil may be diverted therefrom, and by adjusting this resistance the motor may be made to give absolutely constant speed provided the potential supply is constant also. The three methods of construction are shown in Fig. 2.

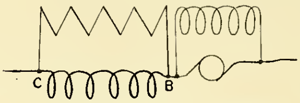


FIG. 3.—METHOD OF ADJUSTING POWER OF SERIES COIL BY SHUNTING.

There is, however, one very great disadvantage with a differential winding. The series coil will sometimes overpower the shunt, giving a very weak reversed field, and consequently a very high speed backward. The reversal from 800 to 1,000 revolutions in one direction to an even greater number of revolutions in the other is not accomplished without a severe mechanical wrench and vicious sparking, alike destructive to commutator and brushes.

It will be noticed from the equation $S = \frac{E}{N F K}$ that the smaller F, and consequently the weaker the field, the higher the speed. Hence the speed of a motor may readily be increased by inserting a resistance in its shunt circuit. However, it must be remembered that the motor will call for more current from the line in order to maintain this increased speed, and it will be found more liable to spark at the commutator.

Ohio Tramway Association.

The annual convention of the Ohio Tramway Association was held in Sandusky on Sept. 25. The meeting was called to order by the president, W. F. Kelly, of Columbus, and the following subjects were discussed: "Best Method of Cleaning and Inspecting Car Bodies;" "What Improvements in Railway Motors are Necessary and Desirable;" "Is a Street Railway Mail Service Desirable? Its Advantages and Remuneration;" "Overhead Construction: Suggestions for Maintenance and New Construction:" "The Best Method of Rotation of Car Crews and Distribution of Runs;" "Prevention of Accidents and the Use of Various Safety Appliances;" "Inspection and Care of Equipments: How Accomplished at the Least Expense;" "Comparative Advantages and Disadvantages with Long and Short Cars;" "Power from Trolley Circuit: Why do Insurance Companies Object?" "Pleasure Resorts Maintained by Street Railway Companies: How Conducted and Maintained so as to be Most Attractive."

The following officers were re-elected for the following year: President, W. F. Kelly; vice-president, Reid Carpenter; secretary and treasurer, J. B. Hanna; chairman of the executive committee, W. A. Lynch. It was decided to hold the next meeting in Mansfield, O., the fourth Wednesday in September, 1896.

W. F. KELLY, PRESIDENT OF THE OHIO TRAMWAY ASSOCIATION.

At the close of the meeting Thomas Wood, secretary of the Sandusky, Milan & Norwalk Railway Company, chartered a steamer and took the entire party a 24-mile lake ride to Kelly's Island. Topics of interest were discussed informally during the ride on the steamer. Upon the return to Sandusky, dinner was served, after which a private car on the Sandusky, Milan & Norwalk Railway carried the visitors to Norwalk where a brief evening session was held, and the business of the convention formally ended.

The following were in attendance at the convention:

W. F. Kelly, Columbus Consolidated Street Railway Company; J. B. Hanna, Cleveland City Railway Company; John Harris, Cincinnati Street Railway Company; H. O. Bradford, Cincinnati Inclined Plane Railway Company; A. E. Lang and Charles A. Demmal, Toledo Traction Company; Reid Carpenter, Citizens' Electric Railway, Light & Power Company, Mansfield; Thomas Wood, Sandusky, Milan & Norwalk Electric Railway Company; H. Sloat, Sandusky Street Railway Company; P. F. Leach, Bass Foundry Company, Ft. Wayne, Ind.; Mr. Wood, Ohio Brass Company, Mansfield, O.; C. O. Evans, Johnson Company, Cincinnati, O.; F. D. Russell, Rochester Car Wheel Works, Rochester, N. Y.

Electric Car Tests.

BY HERMANN S. HERING, M.E.,

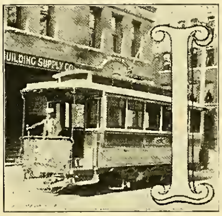
Assisted by

CHARLES REUTLINGER and B. HARRISON BRANCH.

III.—SPECIAL CAR TESTS.

(Continued from page 224.)

Lake Roland Road.



IN this test car No. 64, equipped with "G. E. 800" motors and "K" controllers, was used and run over the road at its best possible speed, the instructions given to the motorman being as before, to run on express time making no unnecessary stops. The instruments used on the car were the same as those used on Car No. 234 during the previous tests, and the general manner of making the test was the same as with the others. Owing to many very sharp curves and the crossing of other railway lines, many retardations and stops were made, that would otherwise have been unnecessary.

Figs. 22 and 23 contain a plot of the results. The scale used is the same as in the previous plots with the exception of the scale of volts and elevation, which changes were made necessary owing to the difference between the two roads. The distances are measured from Oak Street toward City

TABLE V.—GRADES OF THE ROLAND PARK ROAD.

THE VALUES ARE GIVEN OF THE GRADES AT THE POLES.

Pole number.	Grade in per cent.	Pole number.	Grade in per cent.	Pole number.	Grade in per cent.	Pole number.	Grade in per cent.	Pole number.	Grade in per cent.	Pole number.	Grade in per cent.
City Hall											
586	—3.00	531	+3.20	23	+4.40	78	+4.00	133	+2.80	187	+1.75
585	—3.00	530	"	24	+2.40	79	+5.20	134	+2.40	188	+1.00
584	0	529	+1.60	25	+4.00	80	"	135	+1.20	189	+1.00
583	+1.70	528	+2.75	26	"	81	"	136	+0.90	190	+2.20
582	—1.50	527	+2.50	27	+4.40	82	+6.80	137	+0.40	191	+2.40
581	+5.40	526	+1.50	28	+3.40	83	+4.90	138	+0.80	192	"
580	+8.30	525	+5.75	29	—0.08	84	+4.00	139	+1.20	193	+2.30
579	+4.40	524	+0.80	30	+0.50	85	+4.20	140	+2.40	194	0
578	+0.48	523	—0.25	31	+0.70	86	"	141	"	195	—2.40
577	+1.30	522	—3.00	32	"	87	"	142	+1.60	196	—0.90
576	0	521	+0.80	33	"	88	"	143	—0.10	197	0
575	0	520	+2.00	34	—0.30	89	0	144	—2.00	198	+2.00
574	0	519	—2.40	35	—0.70	90	—4.00	145	—1.40	199	+3.60
573	0	518	—2.70	36	—0.80	91	—2.00			200	+4.80
572	0	517	"	37	—0.90	92	—2.80	146	—0.60	201	"
571	+0.36	516	—2.80	38	"	93	"	147	—0.80	202	+3.20
570	+1.10	515	—2.60	39	0	94	—2.00	148	"	203	+0.30
569	+2.30	514	—3.00	40	0	95	+2.75	149	—1.10	204	—2.90
568	+1.20	513	"	41	0	96	+6.00	150	—0.90	205	—6.80
567	+2.90	512	—2.30	42	0	97	+6.10	151	—2.00	206	"
566	+1.20	511	—2.90	43	0	98	+5.80	152	—3.20	207	"
565	+0.13	510	—3.20	44	0	99	"	153	"	208	—5.20
564	"	509	—1.20	45	+2.90	100	+6.40	154	"	209	—4.00
563	"	508	+1.72	46	+5.75	101	+4.20	155	"	210	"
562	+2.40	507	+2.20	47	+6.90	102	—1.60	156	—2.80	211	—3.70
561	+1.40	506	"	48	+5.20	103	+4.40	157	—2.00	212	—2.10
560	+1.60	505	+0.50	49	+4.00	104	+6.80	158	—1.40	213	—1.40
559	+0.90	504	—1.25	50	+2.90	105	+5.20	159	—0.75	214	—1.90
558	"	503	—2.20	51	"	106	+3.00	160	—0.50	215	—3.00
557	+1.20	502	"	52	+2.60	107	+2.00	161	+0.30	216	—4.90
556	+2.80	501	—2.40	53	+2.80	108	+1.40	162	+1.60	217	—5.60
555	"	500	—1.80	54	+3.20	109	+1.20	163	+2.40	218	—5.20
554	"			55	+2.80	110	+2.70	164	+1.50	219	—4.80
553	"	1	+1.60	56	"	111	+3.40	165	—1.20	220	—3.90
552	+3.50	2	+2.40	57	"	112	+3.20	166	—0.60	221	—3.10
551	0	3	+2.60	58	+2.70	113	+2.75	167	+0.70	222	—2.50
550	—8.00	4	"	59	+2.40	114	+2.00	168	+2.50	223	—3.20
549	—5.80	5	+2.00	60	+1.20	115	+1.40	169	+4.40	224	—3.90
548	+2.70	6	+1.20	61	+0.20	116	+0.80	170	+5.60	225	—2.00
547	"	7	+1.90	62	—1.30	117	—1.20	171	+7.00	226	—4.40
546	"	8	+1.60	63	+0.80	118	+2.40	172	+6.80	227	—3.80
545	"	9	+3.60	64	+6.50	119	+2.75	173	+5.40	228	—2.80
544	"	10	+5.50	65	+3.10	120	+0.40	174	+1.50	229	—2.40
543	"	11	+0.00	66	+2.00	121	—2.00	175	—5.20	230	—1.30
542	+3.20	12	+2.40	67	+1.50	122	—2.60	176	1.40	231	"
541	+1.20	13	+3.20	68	+0.90	123	—1.70	177	+0.80	232	—2.00
540	+2.70	14	—2.40	69	+0.84	124	—1.75	178	+2.40	233	—2.80
539	"	15	—5.60	70	+0.80	125	+2.10	179	+3.60	234	—3.70
538	+3.70	16	"	71	+0.20	126	+5.10	180	+6.10	235	—4.30
537	+2.00	17	—0.50	72	—2.00	127	+4.00	181	+1.60	236	—3.70
536	0	18	+2.00	73	—2.90	128	+3.50	182	—1.90	237	—2.50
535	0	19	+1.30	74	—2.50	129	+3.90	183	—0.75	238	—1.30
534	0	20	+2.80	75	—2.40	130	+3.60	184	+1.20	239	—1.50
533	+0.90	21	+4.30	76	—1.70	131	"	185	+2.96	240	—1.12
532	+3.90	22	"	77	—0.40	132	+3.20	186	+2.80	Lakeside.	

Hall and from Oak Street toward Lakeside, which was the system used by the surveyor, and was therefore adopted in this test.

The poles were all carefully numbered prior to the test, and they are plotted to scale in the diagrams, and the distances between them will be found to be very regular. The pole numbers begin at Oak Street and North Avenue, and run up from 0 to 240 at Lakeside, and up from ·500 to 586 at City Hall. The road is double-track throughout, and as it passes through a number of city streets, the curves are necessarily very sharp, as is shown in the plot of the track data. The curvature of the curves in this test is given in feet of radius, owing to the fact that some of the curves are so sharp that they could not be designated in degrees. The plot of the feeders is similar to the other figures, and the cross-overs show where no taps are made. The power house is located near the viaduct at about pole 42, as is shown by the point from which the feeders emanate.

The speed curves are very different from those of the Pikesville road already shown, although the scale is the same in all. As before, this curve was obtained from the autographic record of the Boyer speed recorder by simply replotting it to the scale of the test sheet. Its irregularity is due mainly to the fact that the curves are sharp and very frequent, and that the track in many places is so poor that the see-sawing of the car prevents any high speed from being attained. The average speed was 13.2 miles per hour for the round trip as compared with 20 miles per hour on the Pikesville road. From Roland Park to Lakeside the track is much better, and the curves have a larger radius, and the average speed is 17.3 miles per hour as compared with 13.2 between City Hall and Roland Park.

The curves of amperes show the current to be quite

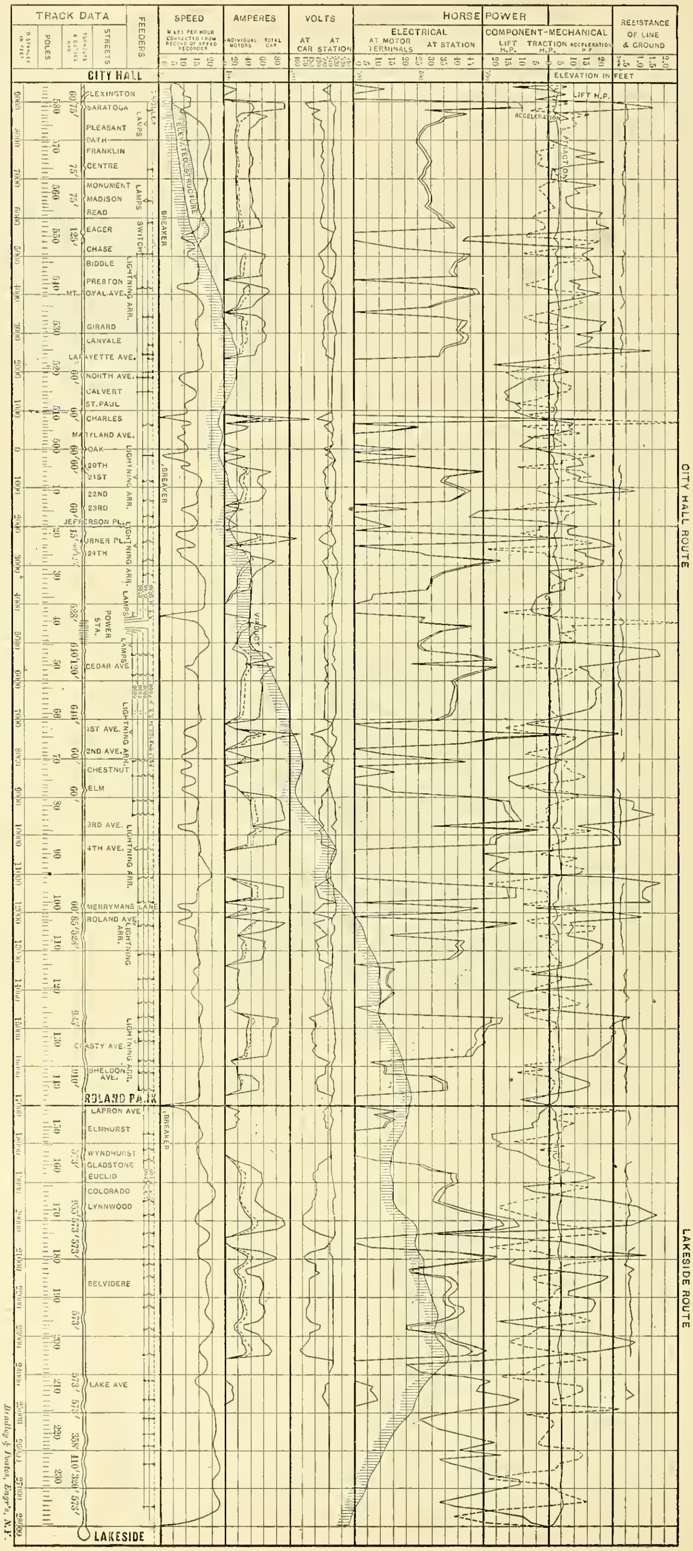


FIG. 22.—CAR AND ROUTE DATA OF SPECIAL CAR TEST, ROLAND PARK ROAD, JUNE 13, 1894.

Car No. 64 run over entire route; no other car on the road at the time. Car equipped with two "G. E. 800" motors and "K" controllers. Weight of car and load 16,215 pounds actual. Plotted on a distance base of entire car route.

A—CITY HALL TO LAKESIDE.

Bradley & Poates, Engr's, N.Y.

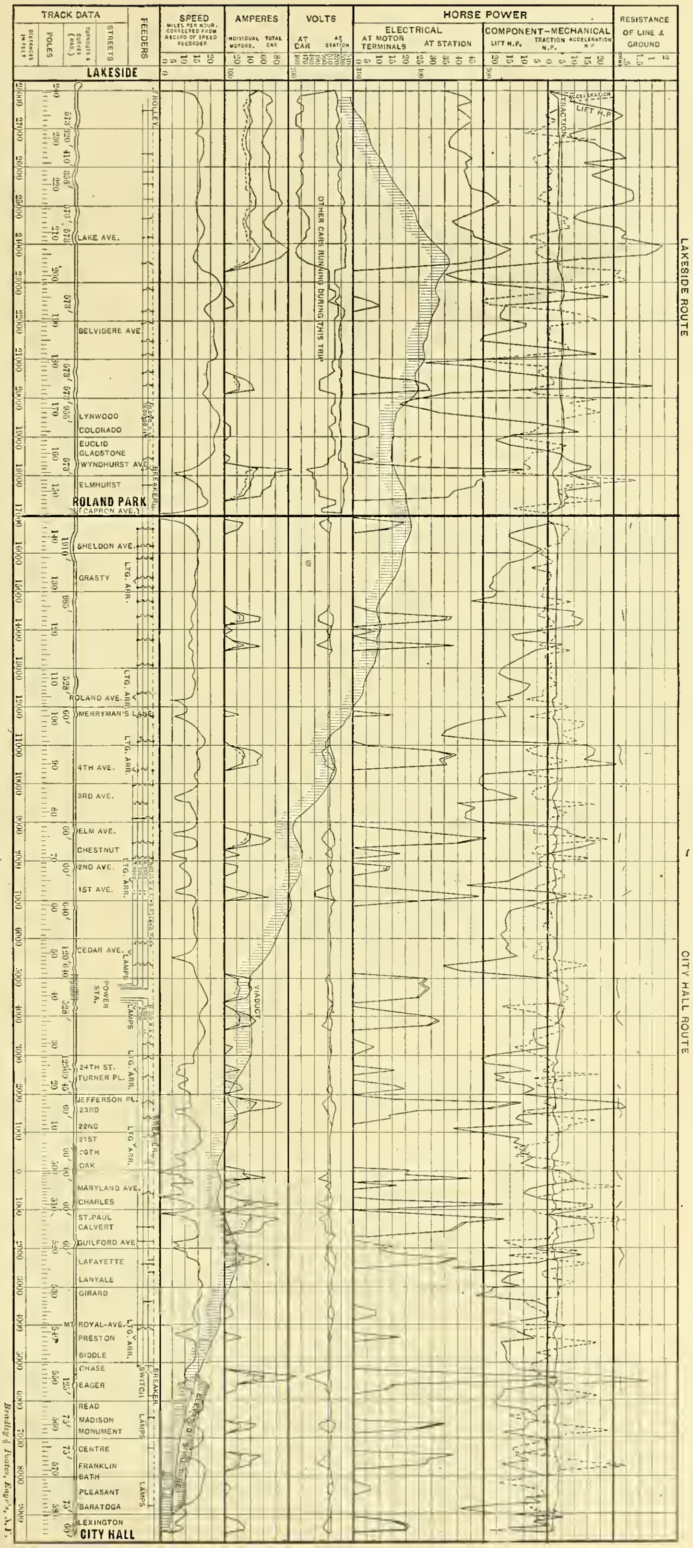


FIG. 23—CAR AND ROUTE DATA OF SPECIAL CAR TEST, ROLAND PARK ROAD, JUNE 13, 1894.

Car No. 64 run over entire route; no other car on the road at the time. Car equipped with two "G. E. 800" motors and "K" controllers. Weight of car and load 16,215 pounds actual. Plotted on a distance base of entire car route.

B—LAKESIDE TO CITY HALL.

Bradley & Poates, Engr's, N.Y.

irregular, and also that a considerable difference exists between the current used by the two motors. In city running where frequent stops are necessary, the current is of course irregular, but the object of this test was to eliminate these variables as much as possible, and for that reason the car was run on express time with the fewest possible number of stops, the variation then being due mainly to the characteristic construction of the road. From pole 25 to Lakeside the road is practically suburban, and the performance of the car on this portion is comparable with that on the Pikesville road, and the great advantage of a good roadbed and track construction is clearly evident. The station volts were determined in the same manner as in the first test, but they will be found to be much more irregular in this test owing to the fact that the machines were considerably overcompounded, and that the slow-speed engines did not regulate as promptly as the high-speed engines of the Pikesville road station. The horse-power curves also show great variations, a necessary result of the character of the road. The mechanical horse-power was obtained in the same way as in the other tests, but the curves show a very much greater variation as will be seen on comparing them.

On the return trip in going from Lakeside to Roland Park, other cars on the road had been started, through a misunderstanding of orders, and that portion of the test will not show the true drop in voltage due to the test car alone, but the other curves of that portion of the test are all right.

Table 5 contains the values of the grades *at* every pole as given in the profile in Figs. 22 and 23. Those marked + are "up grades" and — "down grades" from City Hall to Lakeside. The value of any desired grade on the road can thus be determined.

Fig. 24 contains a superimposition of the speed, ampere, volt and electrical horse-power curves of Figs. 22 and 23, and a comparison of the results of the trip from City Hall to Roland Park and of the trip returning can readily be made. The dotted line shows the curves of the return trip.

Table III gives the principal data and average results of these three tests, from which the difference between the roads as well as the difference between the average performance of the cars can be obtained. In this table the column marked "going" in Test 3 refers to the trip from Roland Park to City Hall.

On comparing the three tests made on these two roads it becomes very evident that for the best results the roadbed and track construction should be of the best character, including heavy rails and perfect alignment, first-class "spring" switches and other "special" work, stone ballast, compound curves of large radius and with suitable pitch for high speeds, large vertical curves approaching the grades, and the least amount of irregularity generally. It is very unfortunate to have the speed limited by the see-sawing of the cars, many unnecessarily sharp curves, "choppy" grades, poor switches at the turnouts and cross-overs, etc., for the delays caused by which the electrical equipment is not responsible. The speed of suburban electric cars should be limited by the power of the motors and the character of the street traffic and not by the imperfections of the roadway.

(*To be continued.*)

As the next two numbers of the Electric Railway Gazette will be devoted especially to the Montreal Convention of the American Street Railway Association, the publication of Prof. Hering's series of articles on "Electric Car Tests" will be suspended until the issue of October 26.

Electrolysis of Pipes.

In the annual report of the city engineer of Boston appears an account of the investigation made to determine the effects of electrolysis of pipes due to escaping street railway currents, the results are given as follows : In certain places electrolytic action has taken place, pipes having been already more or less injured, and are subjected to permanent decay ; excavations which were made gave only negative results, revealing no marked action, and yet not proving that the decay had not been accelerated by electrolysis ; series action is confined to special localities where abnormal currents are flowing, but this action has been reduced to so small an amount that it is not now difficult to detect it ; where such action exists special precaution in providing return feeders and connections with the piping system will generally reduce the difficulty to a small amount. It is impracticable to entirely eliminate electrolytic action, but by a constant inspection and the application of the well-known remedies the danger can be reduced to a minimum ; the action at any point is liable to increase or decrease temporarily, and therefore tests made at any one time are not conclusive, one thousandth of a volt will cause electrolytic action. Measurements of small differences of potential between water pipes and the earth indicate the direction rather than the amount of the current and are not entirely reliable unless special precautions are taken on account of the battery action, thermal effects and other disturbing influences. The most practical way of reducing the liability to injury is by finding the places where the action is occurring and requiring the company to provide suitable return conductors or make proper connections with the pipes or rails. Special provision can be made for measuring the current from the pipes to the ground, and with devices of this sort installed at various places, the most reliable information can be obtained.

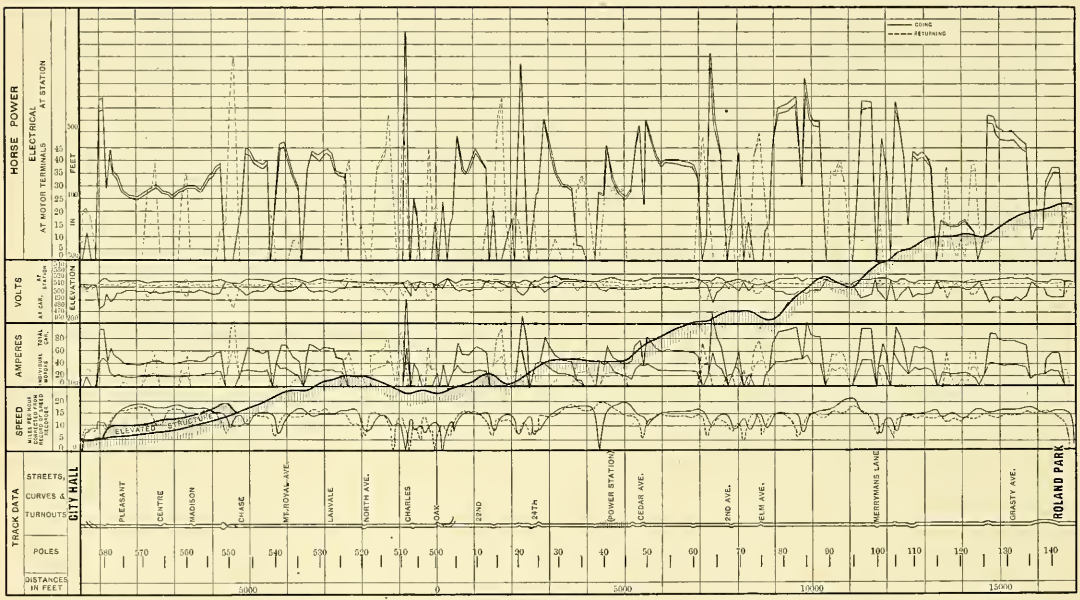


FIG. 24.—COMPARISON OF GOING AND RETURN TRIPS, SPECIAL CAR TEST, ROLAND PARK ROAD, JUNE 13, 1894.
Portions of Figs. 22 and 23 superimposed.

Street Railway Engineers—XXII.

E. J. RICHARDS.

Mr. E. J. Richards holds the position of electrical engineer of the Belt Line Electric Company of Lexington, Ky. After his education in the schools of the city of Boston, he accepted a position with the Thomson-Houston Company, when its factory was opened in Lynn, Mass. For three years he was connected with the company, and throughout this time was engaged in Prof. Thomson's laboratory. When the alternating system was developed, Mr. Richards was sent to Europe as engineer for the firm of Lagana & Co., the agents of the company in Southern Italy, where the Thomson-Houston apparatus came in competition with that of the Zipernawski Company. After a little over a year of successful work in Italy he returned to the United States, and for a short time resumed his duties in the factory in Lynn.

He soon after constructed the lighting plant in Revere, Mass., and while in that city installed for the same company the station apparatus for the first electric railway built by the company at Crescent Beach. Returning to Lynn, he built and equipped the Belt Line road of that city, which was subsequently merged into the Lynn & Boston system.

E. J. RICHARDS.

During the time he was in the service of the Thomson-Houston Company he was frequently employed in investigating troubles encountered with new types of apparatus. The company's first experience in incandescent light was with the old distributer system, by means of which incandescent lamps were run from arc currents. Many troubles were developed in the operation of this system, and their investigation took Mr. Richards to plants in various parts of the country. When the direct-current incandescent system was introduced, one of the first plants was built at Elmira, N. Y. The apparatus was installed by Mr. Richards.

Later Mr. Richards removed to Lexington, Ky., to accept the position which he now holds, and in this capacity he is in charge of the electric railway, lighting and artificial ice interests of the associated companies of that city. The consolidation of the three interests has proved to be a matter of great economy. One complement of employees handles the power plant of the three companies.

From the station between 40 and 50 motor cars are operated, and 10,000 incandescent lights and 100 arc lamps are supplied with current. The plant also furnishes power for a considerable number of stationary motors. The associated companies have a varied activity, for besides the branches already mentioned—electric railway, electric lighting and artificial ice-making—their business includes the district messenger service of the city.

Metropolitan Conduit System in Washington.

A. W. Connett, chief engineer of the Metropolitan Railway Company in Washington, D. C., is quoted as saying, in reference to the new conduit system of that company: "We have been running since July 29 without a mishap of any kind—have not lost a trip or had any delays from rainstorms or anything else. The service is as perfect as can be, so far. The circuit is absolutely tight; there is no leakage of any kind, even in the severest rainstorms, and the amount of power used per car is exceedingly small. We use the train system, consisting of two open cars coupled together, weighing, empty, 22,000 pounds. These cars are moved on an average of 11 amperes per car, with a voltage of 500. We are supposed to average nine miles an hour. The two cars are coupled together tightly, and there is no jerk in starting. This road has cost, for the conduit construction complete, $35,000 a mile, including asphalt paving, which is one third of that amount. Where we took up Belgian block stones and replaced them, the cost was $29,000 a mile. The power-house, cars, etc., are standard, and depend for cost entirely upon what a company wishes to purchase." When it is realized that Mr. Connett speaks of a double-conduit system uninsulated except at its supports, as far as the contact rails are concerned, his remarks deserve more than passing notice, and the Winter performance of the Metropolitan road will doubtless be watched with much interest.

A New Pleasure Resort.

At a recent meeting of the directors of the People's Traction Co. of Philadelphia a resolution was adopted authorizing the expenditure of $250,000 for paying for and improving the 90 acres of land which the company has secured at the Willow Grove terminus of its line. The property will be converted into a beautiful park, the like of which, from an artistic standpoint, according to the directors of the company, does not exist in the United States. A sketch of the contempleted improvements has already been prepared, but, it is claimed, it conveys only a general idea of the beauty and attractions of the park. There will be one large lake and several smaller ones, an electric fountain and a children's playground. In general appearance the park will be a reproduction of a botanical garden. Walks and drives will be laid out, all in an artistic manner, and a handsome restaurant pavilion will be erected. Light edibles and temperance drinks will be sold at prices within the means of those who seek such resorts for a day's pleasure in warm weather. An ice skating pond will be another attraction, and a band of music will be on hand in the afternoons and evenings. If a dancing pavilion is erected it will be an after consideration; it is not included in the present plan.

ELECTRIC RAILWAY GAZETTE

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CORRESPONDENCE IS INVITED upon all subjects of interest to those engaged in practical electric railway work. Prompt and full information regarding CHANGES OF OFFICERS, NEW EQUIPMENT, EXTENSIONS, etc., will be greatly appreciated. Communications intended for a particular issue should reach this office not later than the Thursday morning of that week.

As THE ONLY PUBLICATION in the world DEVOTED TO THE ELECTRIC RAILWAY INDUSTRY, and the only journal adequately treating THE NUMEROUS TECHNICAL FEATURES INVOLVED IN ITS MODERN DEVELOPMENT AND PRACTICE, the ELECTRIC RAILWAY GAZETTE aims worthily to represent the activity and progressiveness of the important interests to which it is devoted. Presenting ALL THE NEWS EVERY WEEK, and describing CURRENT IMPROVEMENTS AND DEVELOPMENTS immediately upon being brought forward, its pages offer to those engaged in the electric railway field the TIMELY ADVANTAGES ENJOYED IN OTHER ACTIVE AND IMPORTANT BRANCHES OF MODERN INDUSTRY, and to advertisers A LIVE AND ENERGETIC MEDIUM commensurate with their needs and one giving CLOSEST ACCESS TO THE COMMERCIAL OPPORTUNITIES OF AN EXTENSIVE AND GROWING BUSINESS.

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HOSTILE LEGISLATION.

In the last two numbers of the ELECTRIC RAILWAY GAZETTE reference has been made to proposed hostile legislation, which State street railway associations have been organized to oppose. Incidents are multiplying which show the tendency to bring forward measures of this kind calculated to work injury to street railway interests. At a meeting of the City Council in Boston this week a resolution was unanimously adopted asking the legislature to grant to it the right to tax the cars of the local company $25 each, and to compel the latter to maintain in repair from curb to curb all streets in which its tracks were laid. In the same city a petition is being circulated praying the legislature to establish three-cent fares on the local railway system. The tendency which exists in Boston may be noted in many other quarters. If legislation of this kind is to be successfully opposed, it would appear that the State associations must be more active in their work. That their work may be more effective than is now possible they should be supported far more cordially by street railway companies generally. There will certainly be opportunities within the next year or two for them to exercise all the strength they can acquire.

RAILWAY COMMUTATORS.

Owing to the necessarily disadvantageous position which a railway motor occupies its commutator is subject to a neglect that cannot well be overcome. It is a generally accepted truth that whenever trouble occurs in a dynamo-electric machine it is sure to manifest itself at the commutator, and usually to the detriment of the latter. The commutator bars of a railway motor, even of the best types, suffer so severely from sparking that they are often completely turned away, and the armature outlasts several commutators. The load on such a motor changes so rapidly that it has seemed futile to adopt any means of automatically adjusting the brushes. The brushes must simply be set at the mean position and left there. There are three positions of a street railway controller that are all important: first, starting at series; second, starting at parallel, and third, full speed ahead. Where the motor is run for any considerable distance it is usually operated at one of these three positions, and a motorman should be trained to select the last two in preference. It would seem feasible to extend the controller spindle under the car and attach to it a cam, which would adjust the brushes simultaneously with the movement of the controller handle, giving them a slightly backward lead as the power comes on. Any desired motion of the brush supports could be very easily obtained.

When the motor was to be run in the reverse direction at the return trip the controller on the other platform would then be used and its cam could be made to give the brushes the necessary reverse lead. In reversing for short distances without using the rear controller the reversing lever could be made to readily disconnect the cam, and thus avoid giving a wrong lead to the brushes. If it would save a single commutator during the life of the machine, such an arrangement would more than pay for itself; but the probabilities are that, if successful, the device would make the life of the commutator equal to that of the motor.

ELECTRICITY vs. STEAM.

The steam railway companies are beginning to realize and admit the value of electric traction for short suburban service. It is confessedly cheaper, but it is more than that—it is popular. Steam roads have severely felt the competition of parallel electric roads for the reason that the public prefer a system of light trains running frequently to one of heavy trains running every half hour. Moreover, the cars of the electric system deposit the passenger much nearer his home, and he can thus well afford the added time resulting from frequent stops. Added to all this, the fare is invariably lower, and the travel, free from soot and cinders, is pleasanter. It has been estimated that it often costs as much as 35 cents to start and stop a passenger train. This sum includes coal, wear and tear, wages, interest, etc. In this respect the electric car has an immense advantage. Even though expense were no consideration, the steam locomotive and its heavy train would be beaten by the electric train, provided each made frequent stops and the same number of them, because the electric train can so much more quickly get under headway. Should the new suburban electric lines that are now being introduced cost fully as much as the steam traction, still the steam would be displaced. A vast number of people engaged in business in the great cities prefer to live in the suburbs, and usually as far away from the city proper as is convenient. The development of electricity on the suburban roads will stimulate the traffic of such roads, for people who have refrained from living in districts reached by these lines will be induced to do so by the better transportation service afforded. The electrical equipment of such roads is now being advocated even by the steam railway journals.

STREET RAILWAY EXHIBITS.

It will be seen from a diagram of the exhibition hall in Montreal, which we publish elsewhere in this issue, that manufacturers propose to make a creditable display of street railway apparatus and supplies at the convention of the American Street Railway Association. This feature of the annual meetings should certainly be one of the great attractions and should prove not less valuable to the street railway men than to the exhibitors. If the exhibit includes what it should embrace it enables the former to see in the shortest possible time the newest and best in material, and it affords to the manufacturers an opportunity not only to sell goods, but what is hardly less important, they are able to obtain the ideas based on actual experience of those who use the apparatus. In order that the best results may follow from exhibitions of this kind provision should be made in the convention programme so that ample time will be allowed for the inspection of the displays. No fault in this respect can be found with the arrangement at Montreal. During the hours when the visitors are inspecting the exhibits some one should be in charge at each booth to give information. It is too common a custom to make an exhibit and then let it speak for itself during the convention. At one exhibition which we have in mind the executive officers of one of the largest street railway companies in the country made several ineffectual attempts to find the representative of an exhibiting company, and finally left the hall without the information of which he was in search. The manufacturer of that exhibit in all probability lost a customer. The committee in charge of the exhibits also has a duty to perform in seeing that the convention visitors have a fair chance to see what has been arranged for their inspection. It not infrequently happens that large numbers of persons attracted by a free show crowd the exhibit hall to such an extent that an examination of apparatus is out of the question. This was notoriously the fact when the last exhibit was made in Montreal, on the occasion of the convention of the National Electric Light Association, in 1891. The residents of that city may have had an opportunity to see the exhibits, but certainly those who attended the convention did not have a fair chance. The exhibit this time will probably not be of so attractive a character, but certainly arrangements should be made to limit the attendance during certain hours in order that the inspection of street railway men may not be interfered with.

Street Railway Convention in 1896.

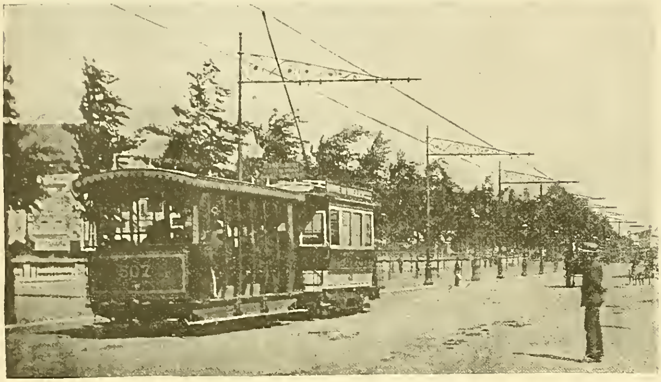
The St. Louis *Globe-Democrat* prints the following in reference to the convention of the American Street Railway Association in 1896: "The St. Louis delegation want the 1896 meeting held in this city. Their wish will be gratified, that is certain. St. Louis is a great convention city, and although there will be other cities bidding for the honor, St. Louis will get it by the mere asking. The fourth annual meeting, in 1885, was held in this city. The Association was a small affair then, and it was in the 'horse-car days.' Unfortunately, St. Louis street car employees were on a strike at that period, so that the local officials could do very little in the way of entertaining. St. Louis wants to show how it can entertain a modern railway association. St. Louis is world renowned as an electric street railway centre, which is an entertaining and instructive exhibit of itself."

Restoring a Punched Ticket.

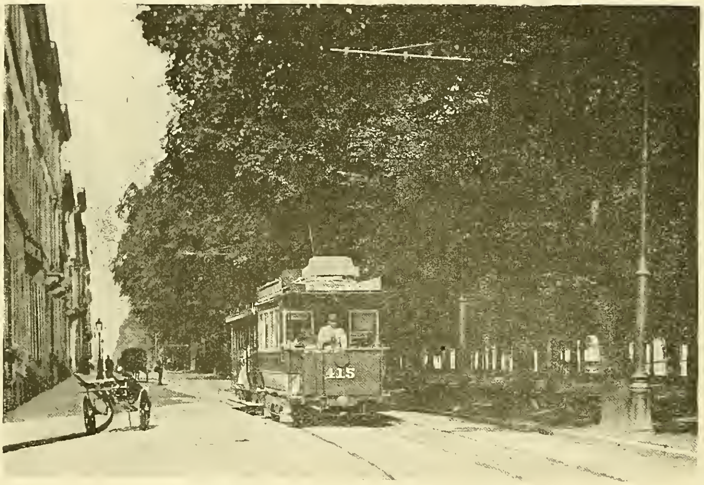
A policeman was recently convicted in Detroit of "plugging" a street railway ticket. The figures which had fallen from the conductor's punch had been preserved, and had been pasted in position so neatly as to be scarcely noticeable. The policeman endeavored to escape punishment by shifting the blame to the shoulders of his young son, but this story was not believed.

Brussels Suburban Electric Line.

The electric roads of the Suburban Railway Company, of Brussels, which has been in operation for about 15 months, is one of the principal street railways in Belgium. It is about six and one-fifth miles in length, and was installed by the Union Elektricitats Gesellschaft, the German company which exploits the patents of the General Electric Company. The Brussels railway is of special interest from the fact that the introduction of electricity on the line marks the beginning of the change from the steam locomotive to the motor car on roads of this class. The Suburban Railway Company, with headquarters in Brussels, owns in Belgium tramway lines of an aggregate length of 735 miles. Some of these are of standard gauge and others of 39-inch gauge, but all are operated by different licenses. The company has owned 226 locomotives, 622 passenger coaches, and 1,328 freight cars. The company, after a careful investigation, determined to adopt so far as possible the overhead trolley system, and the first installation was that which is described herewith.

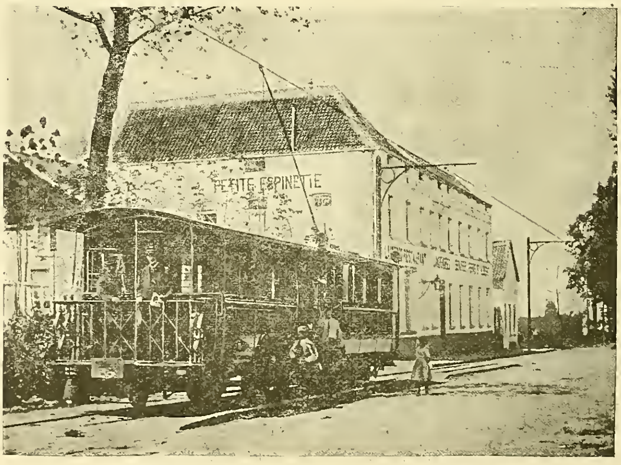


BRACKET LINE CONSTRUCTION.



OVERHEAD CONSTRUCTION IN THE CITY.

Considerable opposition on the part of the municipal authorities of Brussels to the overhead wires was expected and encountered, but as Brussels is a capital city, the concession was obtained directly from the Belgian government, not, however, before the government authorities had examined the installation and the operation of the electric road at Remscheid, Germany, the route of which offers almost every difficulty in the way of curves and grades.



OVERHEAD CONSTRUCTION IN THE SUBURBS.

The generating station was built at Cureghem, a suburb of Brussels. Almost all the apparatus employed is American. The boilers of which there are three, are from the works of the Babcock & Wilcox Company. Space has been left for a fourth, which is shortly to be set up. The boiler are supplied by duplex feed pumps, any one of which can supply the entire battery.

The engines are of the McIntosh & Seymour make, of 160 hp, each running at 235 revolutions per minute. The proximity of the Seynne stream makes it possible to operate them condensing Water is brought from the station by a subterranean pipe 220 metres long, and the hot water flows back to the river through cement conduits.

The electrical plant consists of three 100-kw multipolar General Electric generators, driven by belt, and one of 150 kw, which is directly connected. They are over-compounded machines, running at 625 revolutions per minute, and furnish current for the line at 600 volts.

The track is laid with T-rails of 45 to 60 pounds to the metre, set on wooden crossties with guard rails of steel. They are bonded together and to a supplementary return wire. The trolley wires in the city are suspended from brackets, and in narrow streets, from span wires attached by ornamental rosette bolts to the sides of the houses. Two of the illustrations show a system of bracket suspension, where the two wires, one for each track, are suspended from one ornamental bracket. Along the road to Waterloo wooden side poles are used. The overhead construction was built unusually strong, because the trolley trains are designed to run at a speed of 25 miles an hour and over. The feeders are carried underground in the city, and in the air when the suburbs are reached. Lightning arresters are set at frequent intervals and every precaution is taken to prevent interruption of the service. The curves and grades are frequent, the latter ranging from two to six per cent.

The cars employed are of continental type and make. Each is equipped with a double equipment of G. E. 800 motors and "K" controllers. Each motor car is designed to carry 35 passengers, and to draw a trailer carrying the same number. On Sundays and holidays the cars are crowded, in true American fashion.

Since the road has been electrically equipped the traffic has more than doubled. Formerly the steam trains stopped only at certain points. Now the trolley trains stop whereever signalled along the line. The company was able to secure for the trolley line a franchise to operate along the Chaussée de Waterloo, which presents a considerable gradient. Had steam been employed it would have been necessary to purchase a right of way, and then to level it.

New York Rapid Transit.

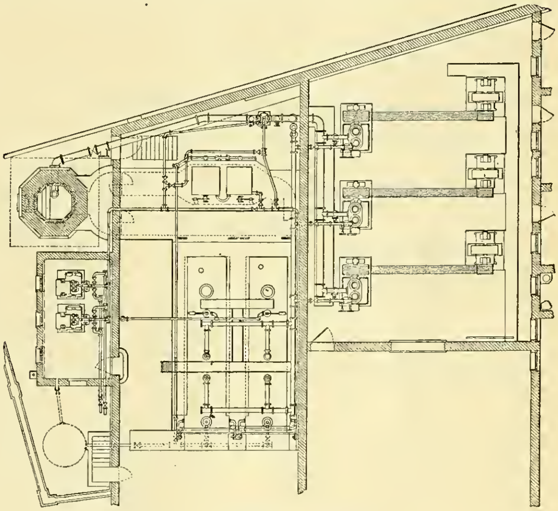
The rapid transit commission has resumed its work after a long Summer vacation. At a meeting a few days ago Engineer Parsons submitted the result of actual surveys, showing the size, location and use of all the vaults under the sidewalks between the Battery and Fifty-ninth Street, on Broadway, and below Thirty-third Street, on Fourth Avenue, and maps showing the locations of all sewers and pipes in the streets affected by the proposed underground railways. At a meeting on Tuesday he submitted a short report showing the character and value of this work.

The commissioners took up the consideration of his report upon proposed stations. They approved the greater number of those he had proposed, but agreed upon some changes. On the Broadway route, instead of stations at Liberty and Fulton Streets, others were substituted at Cortlandt and Barclay Streets. On the west side the Walker Street station was made a local and express station. Twenty-eighth Street was substituted for Twenty-seventh Street, and the Thirtieth Street station was dropped. Sixtieth Street was made a combined local and express station, Seventy-second Street made a local station only, Ninety-sixth Street a combined station, and all the others on the west side made local only, except 110th Street. Above 133d Street all stations will be both local and express.

On the Fourth Avenue line Fifty-ninth Street was substituted for Fifty-seventh Street, Ninety-sixth Street for Ninety-fifth Street, and all the others were temporarily approved. Mr. Parsons promised that the plans for the railway structure itself would soon be ready, and his report said that the studies already completed indicate that the quantities and prices assumed in his preliminary estimate will prove to be amply sufficient to cover the cost of the work of building the lines already adopted.

Electric Railway in Bristol, England.

The electric railway at Bristol, England, which is now practically ready for operation, is for more than one reason an interesting installation. It is the first road constructed in accordance with the rules of the British Board of Trade, and as the first modern electric road in Great Britain "it will probably serve as the type for others in different parts of the country." The prediction is quoted from *Engineering*, of London, from which the following description of the railway is obtained: To comply with the new regulation of the Board of Trade, not only is very careful workmanship required, but certain special appliances are needed. The chief object of the new rules is to insure that no prejudicial effect shall take place, and arrangements are made for ascertaining and recording the source of any electrical disturbance during the whole period of work. The Board of Trade insists that "a continuous record shall be kept by the company of the difference of potential during the working of the tramway between the points of the uninsulated return furthest from and nearest to the generating station." When the difference exceeds seven volts it must be reduced, or the working of the line stopped. In another clause it is stipulated that the insulation of all feeders and conductors shall be so maintained that the leakage shall not exceed $\frac{1}{100}$ ampere per mile of tramway.

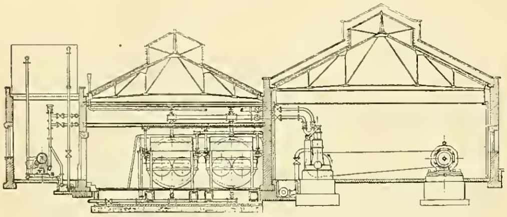


PLAN OF POWER STATION.

The electric line commences at the western, or city, end of Old Market Street, where it joins two lines of horse cars. There is a double track for most of the route, and at the starting point there are four roads, with cross-overs, to suit any arrangement of traffic.

The general arrangement of the power station is shown in the accompanying diagrams. The contract for engines, boilers, generators and other electrical appliances, as well as for the cables and cars, was given to the British Thomson-Houston Company. There are two Lancashire boilers, which are 30 feet in length. They are fitted with Green fuel economizers, and two pairs of Vicars mechanical stokers. The two feed pumps, each of which has a capacity of delivering 16,000 pounds of water against a boiler pressure of 160 pounds, are driven by electric motors.

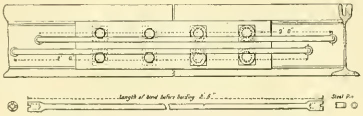
The engines are of the Willans central valves compound type, and give 134 i.hp at 380 revolutions, with a steam pressure of 120 pounds. The fly-wheels are 3 feet 8 inches in diameter, and are grooved to take ten 1¼-inch cotton ropes for driving the generators. The latter are multipolar machines, three in number, giving an output of 200 amperes at 550 volts when working at 650 revolutions.


ELEVATION OF POWER STATION.

A motor generator has been installed for supplying current to accumulators and for lighting the station. Four electric motors are in service, two of which drive the pumps, as already stated; one operates the stokers, and the fourth furnishes power in the repair department.

One special feature of the installation is the use which has been made of accumulators. Of these there are two descriptions, the main, and the car lighting accumulators, both of which have been supplied by the Chloride Electrical Storage Syndicate. The main accumulators consist of a battery of 55 cells, with 15 plates in each cell. They are of the special protected type, and each cell has a capacity of 546 ampere-hours, when discharged in six hours. The low-tension current for charging these cells is obtained from the motor generator, and from them current is taken for lighting the station when the generator is not in use, and also for charging the small accumulators for car lighting. As power may be required for the stationary motors, when the main generators are shut down, arrangements are made by which the low-tension current from the cells can be used to drive the low-tension side of the motor generator, giving a high-tension current for the motors.

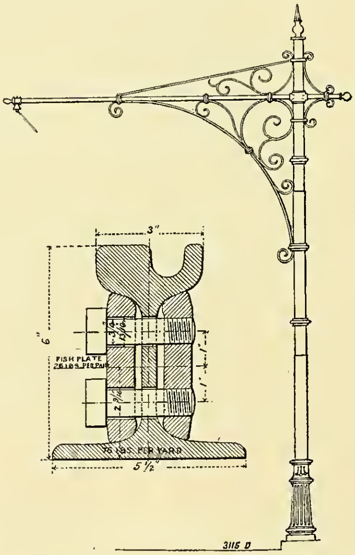
The new rails which have been laid weigh 26 pounds to the yard and have unusually heavy fish-plates. It will be noted from the illustration that no nuts are used. The fish-plates on one side are tapped, and the bolts, which are ¾ inch in diameter, screwed into them. The groove for the wheel is an inch wide and ⅞ inch deep. No cross-sleepers are used, but the rails are bedded on concrete 6 inches thick, extending the full width of the tramway. They are connected by four cross-ties to each 30-feet length. These ties are flat steel bars, 2 inches by ⅜ inch, with two nuts at each end, bolted through the web of the rail. The rails are bonded by two copper rods, 0.4 inch in diameter, and widened out at each end. The ends of the rods are passed through holes which have been drilled in the rails, and they are then secured by a steel pin being driven into them.



DOUBLE BOND.

There are 12 motor cars, each able to draw a trailer after it. They were made by Milne & Co., of Liverpool, the trucks being of the American Peckham cantilever standard type. The cars will seat 18 persons inside and 26 on the roof; the length inside the body is 12 feet 9 inches, and that over the platform is 24 feet.

There are two separate systems of lighting the cars, and they will be employed simultaneously so that the cars may be illuminated in case of a failure of the trolley current. In the trolley-lamp circuit there are five lamps, all 16-cp. The accumulator lighting consists of one lamp on a standard on the roof, a colored bull's-eye lamp at either end of the car and a head lamp on the hood over the driver. The first three of these are 16 cp, and the head lamp is 32 cp. There will be head lamps at either end, but only the one on the front of the car will be lit. When the batteries are charged they are pushed on to a small truck and taken from the accumulator room to the cars. There is a space for a five-cell battery at either end of each car; they are pushed in from the outside, and the connection is made by means of an automatic spring contact at the back. Each pair of storage batteries will be sufficient to keep the lamps which depend on it alight for eight hours.



SECTION OF RAIL AND POLE.

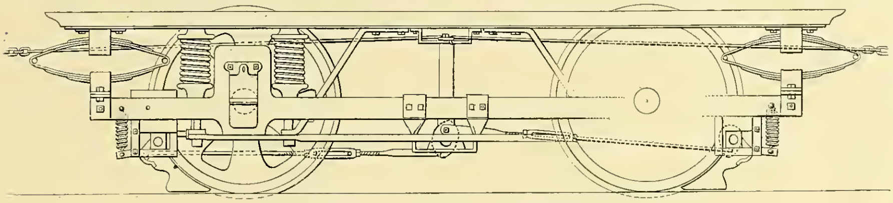
The type of pole used on the line is shown in one of the cuts. It consists of steel tubes made in three lengths which are shrunk together. The tube enters the ground for a distance of six feet and over it a cast-iron base is passed and bedded in concrete. The trolley wire is hard-drawn copper .32 inch in diameter.

Brooklyn Trolley Party.

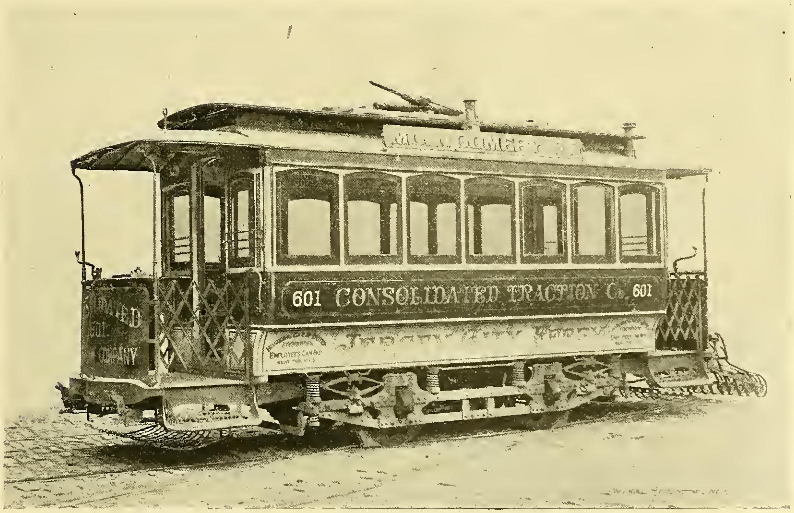
One of the attractions arranged for the New York State Christian Endeavor Convention, to be held in Brooklyn next week, is an elaborate trolley party. A ride about the city occupying fully two hours has been arranged, and it is expected that a sufficient number will join the excursion to make it one of the largest trolley parties ever organized.

The Tandem Brake.

The accompanying illustrations show a brake shoe and mechanism which certainly appear very powerful and effective. The shoe is of such a shape that the car treads on its own apron, so to speak, and is quickly brought to a stop thereby. The company claims that the action is gentle and effective, and it would seem that the only criticism that could be passed is that the brake would stop the car too quickly. If this is overcome as claimed, the brake is certainly worthy of notice. The shoe need only be advanced by the lever till it touches the wheel and track, when it will of itself become set by the car rolling upon the shoe. The wheel will be stopped and the car, if it skids at all, will slide with its main weight on the brake shoe, thus preventing flat wheels. The shoe also acts as a fender, any object upon which the wheels inpinge being pushed along rather than rolled upon by the wheel. The need of a powerful efficient brake is too well known to really expatiate upon. With a reliable brake fewer cars will serve the same line, as faster time may be made. Accidents will, of course, be less frequent. The tandem brake is a track and wheel brake combined, and is said to be efficient on a wet or dry rail on any grade that the car can climb. The criticisms on ordinary methods of braking are many. It is not sufficient to stop the wheels. The idea of a brake is to stop the car. Powerful and easily operated wheel brakes are many, but after they are able to stop the wheels they cannot be improved, as far as power is concerned. In fact it is found better to allow the wheels to turn very slowly till the car stops. The tandem brake aims to stop the wheels, and also to seize the track by powerful friction, backed up by the whole weight of the car. The brake is manufactured by the Tandem Brake Company of New York.



TRUCK WITH BRAKE APPLIED.



JERSEY CITY CAR EQUIPPED WITH TANDEM BRAKE.

A Detroit Proposition.

A remarkable communication from the Detroit Railway Company was received and read at the last meeting of the Common Council of Detroit. Briefly stated, the proposition of the Detroit Railway is that the city shall obtain possession of the Citizens' Company's tracks and lease them to the Detroit Railway at a rate of 3½ per cent. interest on the amount paid for them—the Detroit Railway to pay for all cars and overhead equipment and to keep the road in repair, while the city would pay for all repaving.

Moreover the company expresses its willingness to sell its own entire trackage to the city, and then lease the lines from the latter on the same terms proposed for the lease of the Citizens' Company's tracks, 3½ per cent. on the purchase price. Any necessary renewal of tracks is to be paid for by the city, and the cost added to the amount upon which interest is to be paid by the company. The latter agrees, in case such an arrangement is entered into, to carry all passengers on all lines at all times, day and night, for a uniform fare of 3 cents, to give universal transfers and to sell 40 tickets for $1. In conclusion the communication, which was signed by Vice-President Henry A. Everett, set forth these statements:

"As an evidence of our good faith in making this proposition, we will enter into a bond, obligating ourselves to execute the proposed contract. We are willing that such bond shall contain a further provision that if this proposition is accepted by the municipal authorities of the city of Detroit, we shall agree to make the same proposition to each succeeding Common Council until the consummation of the agreement by a final contract. In conclusion permit us to say that our present enterprise has met with a success far beyond our expectations. It has been clearly demonstrated that low fares are so appreciated by the people that street railways can be operated for such low fares at a reasonable and just profit. A general reduction, upon the terms proposed, covering the entire city, we are satisfied, will result in such an increase of business that we have no doubt from our experience in the practical operation of street railways in this and other cities, that it will prove to us a wise and advisable business venture. It is understood that the proposed contract shall continue during the life of our present franchise, and embrace all street car tracks and lines operated in the city of Detroit."

A committee was appointed to take the matter into consideration.

Comments and Views of Contemporaries.

Blockading Electric Cars.—Has a private coal dealer any legal or moral right to obstruct travel and delay hundreds of people journeying to or from their daily toil? The latter half of this interrogatory would be promptly answered in the negative by those who have been at any time delayed in the manner above described. The first half of it should be answered in the same manner by the law-making body of the municipality. No man has a right to steal or appropriate the valuable time of hundreds and thousands of others, and the Councils should see to it that no man has the power to do it.—*Philadelphia Times.*

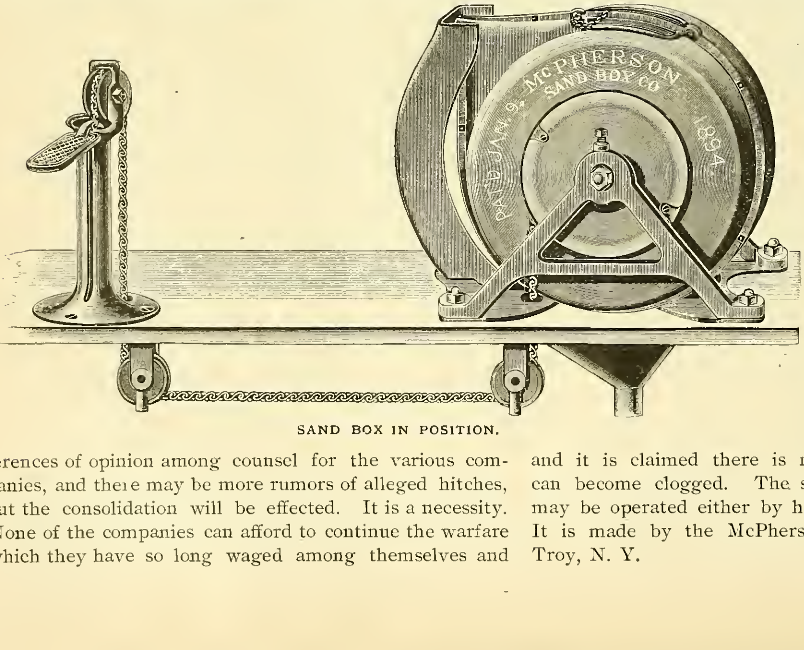
Freight on Electric Lines.—It is plain that the electric freight car has its own claims, and will ultimately finds its way even into the remoter districts. This is, in fact, so reasonable and certain, that we may expect to see electric feeder lines branching out along and in connection with our steam railways. These are not only susceptible of such additions, but would be in accord with the business sagacity and enterprise of steam railway management. The science of transportation has not yet reached its perfection or climax, and in its commercial aspects, and as a source of investment and revenue, the same keen business instincts that have made our steam railway system what it is, will certainly not leave its new opportunities unappreciated. But with or without this co-operation the electric freight car is a coming factor in local business.—*Age of Steel.*

Consolidation Certain.—The consolidation of the Electric, the People's and the Philadelphia Traction companies is certain of accomplishment. There may be differences of opinion among counsel for the various companies, and there may be more rumors of alleged hitches, but the consolidation will be effected. It is a necessity. None of the companies can afford to continue the warfare which they have so long waged among themselves and which has cost them thousands of dollars. To abandon the scheme at this time would mean a fight to the bitter end, and there is reason to believe that it would be short, sharp and decisive, with in the end one or more of the companies in the hands of receivers. This is the true situation to-day, and while it may be ridiculed by officials of the companies, it is real nevertheless. The companies, therefore, have to choose between prosperity on the one hand and a ruinous fight on the other. Such being the case it is not difficult to judge which course they will pursue. The consolidation will be effected in due time.—*Philadelphia Stockholder.*

Electric Railways.—The electric railway has made so much greater progress in America than it has abroad that this country may almost claim it as an "American institution." At the beginning of this year there were but 434 miles of electric road in all Europe and more than half of that was in Germany, France having less than 60 miles. In the United States the latest statistics show 10,363 miles, while in New England alone there is more than three times as much electric railway as in all Europe. Now that the success of the electric motor on short lines hitherto operated by steam is assured, the mileage will increase still more rapidly and will very likely be doubled within a short time. The suburban resident uses the railway for business rather than for pleasure, and while frequent trains and reduced rates would be advantageous to him, it is doubtful whether he would increase his journeyings to an extent which would make it profitable for the company. If, however, the electric line is less expensive to operate than the steam line, its advantage for suburban purposes is obvious. The great thing was to show that the electric motor was adaptable to regular railway traffic on short lines, and this has been proved to a certainty.—*St. Paul Pioneer Press.*

McPherson Sand Box.

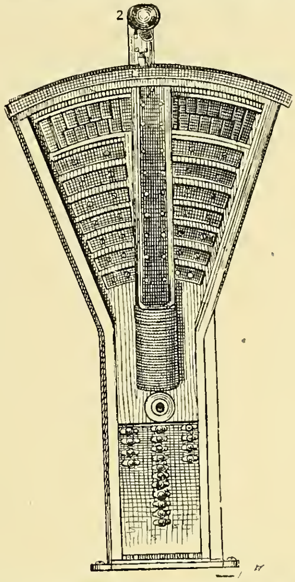
The McPherson sand box which is shown in the accompanying illustration is designed to be placed directly under the seat of a car. The box is cylindrical or drum-shaped, holds three quarters of a bushel, and has a rotary motion which causes the sand to roll from the top in the same manner as if poured from a pitcher. The spout is so shaped that any obstructions that may come in the sand will not stop the flow. The special feature of the device is the rolling movement by which the sand is frequently agitated. The sand, when the box is turned, rolls from the top as it has been already stated. There are no valves or mechanism to get out of order, and it is claimed there is no way in which the box can become clogged. The sand box is designed so it may be operated either by hand power or foot power. It is made by the McPherson Sand Box Company, of Troy, N. Y.



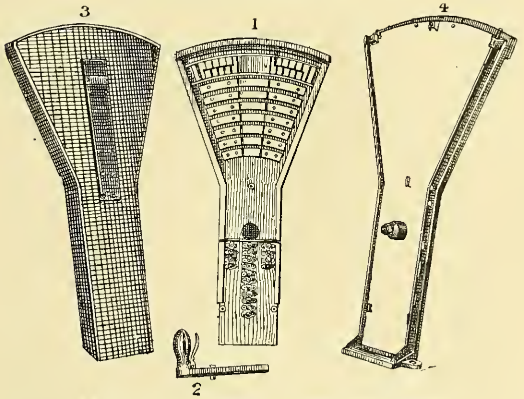
SAND BOX IN POSITION.

New Electric Car Controller.

The accompanying cuts represent a new form of controller, for street railway use, which has recently been patented by Clyde Landers, of Tacoma, Wash. In the design of this controller it has been the aim to combine the better parts of both the rheostat and the series-parallel methods in a simple, compact and easily operated form. As is well known, the electrical efficiency of the rheostat is not as high as that of the series-parallel method, yet it may be said that its use proves much easier on the gearing and car in general, as well as more agreeable to passengers than with the series-parallel method. There are generally two levers to be handled, one for controlling the speed and the other for reversing the motion, while with this new method only one lever is employed, which controls both the direction of the car and the speed. With this controller the rheostat method is adopted, but it is operated in a manner different from that usually employed.



CONTROLLER COMPLETE, WITH CASE REMOVED.



FRONT OF THE BOARD, CASE AND COVER.

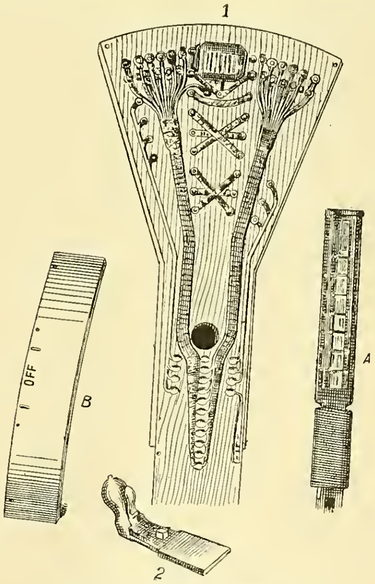
It is, as the cuts show, very compact, and is placed flat against the dashboard of the car, occupying very little space. The handle or lever moves sidewise or across the car and is at the "off" notch when in the centre. A movement to either side starts the car ahead or backward, according to the connections, and as the movement is continued the speed is increased until it reaches a maximum.

The controller consists essentially of three parts, a cast-iron back, the board upon which the contact plates are fastened, and the lever with contact buttons. The board upon which the contact plates are fastened is built up of three thicknesses of hard wood. The plates are fastened to one side and all the connections are made on the back of the board. As will be seen, all the parts are very accessible.

The board fits into the cast-iron case, and the lever *A*, with contact buttons, is placed in front of it. The lever is pivoted and extends through the case at its lower end, and then extends upward, terminating in the handle. This handle can be removed when at the "off" notch only, and when removed, lever *A* is locked in this position.

The plates at the upper end of the board are all connected to the middle row of buttons at the lower end, while these latter are then connected to a resistance coil, thus forming a rheostat. The other plates are connected to the buttons at either side, which are in turn connected to the motors.

From the construction it is plain that the motors cannot be reversed when the rheostat is not in circuit, that is, the current must be shut off before it can be applied in the opposite direction, thus avoiding a strain to which the motors and gears are sometimes subjected.



BACK OF THE BOARD AND LEVER.

While in this form of controller the electrical efficiency is no higher than that of a rheostat, it possesses some features which are worthy of mention. It occupies a very small amount of space, and the movement is not only simple, but quick, features which are valuable in cases of accident. The construction is such that there is no apparatus placed under the car, and the only movable part in connection with it is the lever, which is very simple. It is claimed that these controllers can be made very cheaply, and may be applied to any kind of motors.

FINANCIAL NOTES.

NEW ORLEANS TRACTION EARNINGS.—The gross earnings of the New Orleans Traction Company for the month of August were $113,316, a gain of $39,826, while the net earnings amounted to $39,915, against $22,250 a year ago, a gain of $17,269.

TO BE REORGANIZED.—The St. Joseph (Mo.) Traction & Lighting Company has sold its electric light property, and the company will be reorganized with an increased capital stock. Bonds will be issued to the extent of $500,000 for the purpose of improving and extending the electric railway plant.

CHANGE IN OWNERSHIP.—The Bergen County Traction Company has passed into the control of the Elkins syndicate, of Philadelphia. The syndicate proposes to build lines between Bergen County and Hudson and into Essex County, and will apply for a franchise for a road between Hackensack and Newark.

COUPON NOTICES.—The Columbus Railway, the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction and the Lock Haven Traction companies have given notice that the coupons due on Oct. 1 on their bonds will be paid on demand at the office of the West End Trust & Safe Deposit Company, Pittsburg, Pa.

PITTSBURG, MANSFIELD & CRAFTON BONDS GUARANTEED.—At a meeting of the stockholders of the Pittsburg & West End Passenger Railway Company, held at the company's office, Carson Street, at 3 p. m., Sept. 26, it was decided to guarantee $250,000, 5 per cent. 30-year bonds of the Pittsburg, Mansfield & Crafton branch.

RECEIVER APPOINTED.—The application made by the Baltimore Trust & Guarantee Company for the appointment of a receiver for the Overland Electric Railway, Nashville, Tenn., was heard on last Saturday by United States Judge Lurton, and granted, and H. M. Doak, clerk of the United States Circuit Court, was appointed receiver temporarily until a further hearing is held on Oct. 20. The receiver took charge immediately.

ATLANTIC AVENUE (BROOKLYN) RAILWAY EARNINGS.—The unfavorable report of the Atlantic Avenue Railway (which is controlled by the Brooklyn Traction Company) for the year ending June 30 is considered to be due principally to the strike of the employees last Winter, the effect of which, however, has about worn off. The net earnings for the year show a decrease of $183,299, while the fixed charges increased $49,865, leaving a deficit of $91,709, against a surplus of $115,226 last year.

STOCK INCREASE CURTAILED.—The board of railway commissioners has authorized the Lowell & Suburban Street Railway Company, which petitioned for authority to issue $400,000 new stock, to pay floating indebtedness and purchase a pleasure park at Tyngsboro, to issue $176,500 stock for the indebtedness and $63,500 for the park. The new stock must not be sold at less that $115 per share, which will give the company $103,975 for the floating debt and $73,025 for the amusement enterprise, making a total of $276,000.

LEASE OF THE PHILADELPHIA TRACTION COMPANY.—At a special meeting of the stockholders of the Philadelphia Traction Company this week the lease to the Union Traction Company, the new consolidated company, was ratified by a vote of 278,881 shares out of a total of 300,000 shares. The resolution passed at the meeting authorized the board of directors to lease the system to the Union Traction Company for 999 years from Oct. 1, 1895, upon guarantee of 8 per cent. net on the amount of capital stock issued, and the payment of interest charges on the collateral trust bonds, the lessee to assume all liabilities as to rental and interest charges of the various leased lines under control of the Philadelphia Traction Company.

EARNINGS IMPROVING.—The statements of operations of the Paterson Railway Company continue to show steady improvement. The figures for August have just been issued, and a material gain in gross and net is reported. The former amounted in the aggregate to $30,188, an increase of $6,464, while the net was $14,602, an increase of $5,718. This indicates an increase in operating expenses of about $745. For the eight months ended Aug. 31, gross earnings amounted to $192,405, an increase of $32,704, while operating expenses were $115,271, an increase of $7,775. Net earnings, therefore, were $79,133, against $54,204 for the corresponding period last year, an increase of $24,928. It is understood that several large blocks of this company's stock have recently been purchased by Philadelphia parties.

THE UNION TRACTION COMPANY.—The Union Traction Co. of Philadelphia practically began its official existence on Tuesday. The directors of the various companies are well satisfied with affairs, and they look upon the street railway amalgamation as about settled. The earnings of the Electric and People's Traction companies beginning Oct. 1 will be put aside to be turned over to the Union Traction Company when everything is ready for the new corporation to receive the assets. The stockholders of the Philadelphia Traction Company paid their first installment of $5 on the Union Traction stock Tuesday. Payment on the stock by the People's and Electric Traction companies has been deferred for the present. It is stated that the amount of floating debt of the Philadelphia Traction Company which the Union Traction Company will assume in consideration of the transfer to it of securities in the Philadelphia Traction treasury, amounting, it is said, to more than $5,000,000, will not be more than $4,000,000. A guarantee is to be given to the Union Traction Company, it is stated, that, should the debt when all work is completed be found to exceed $4,000,000, the Union Traction Company will not be held responsible for the excess. It is said that this guarantee will be given by capitalists who are confident that the floating debt of the Philadelphia Traction Company will not exceed the amount stated.

NEWS OF THE WEEK.

TOWANDA, PA.—Work on the Towanda & Canton Railway will be commenced next week.

TANNERSVILLE, N. Y.—The construction of an electric road from Otis to Tannersville is contemplated.

NEW YORK, N. Y.—Street railway postal cars are now operated over the lines of the Third Avenue Company.

NORTH EAST, PA.—It is reported that a company with a capital of $250,000 will build a trolley road from North East to Erie.

CATSKILL, N. Y.—An electric road will be built from Catskill to Windham by the Catskill, Cairo & Windham Street Railway Company.

MEADVILLE, PA.—The right of way for the proposed electric railway, from Edinboro, Erie County, to Cambridgeboro, has been secured.

TIFFIN, O.—The horse car line of Tiffin has been purchased by Hatcher & Yeager, who will immediately put in an electrical equipment.

COHOES, N. Y.—The Cohoes City Railway Company will probably extend its tracks to West Troy to connect with the Albany City Railway tracks.

AMSTERDAM, N. Y.—It is proposed to extend the Amsterdam street railway to Johnstown and Gloversville, and it is expected that work will be begun in the Spring.

ERIE, PA.—The talk of building an electric railway from Erie to North East has been revived. It is said that Hon. Alfred Short is one of the parties back of the new road.

BALTIMORE, MD.—The Columbia & Maryland Railway Company has made application for permission to lay a double track or single track electric railway on Wilkins avenue.

HALIFAX, N. S.—The Halifax Electric Railway Company has ordered two 300-hp Robb-Armstrong engines in addition to two of the same kind now under construction.

OSWEGO, N. Y.—The directors of the Oswego Street Railway Company have increased the capital stock from $125,000 to $200,000, and extensive improvements will be made.

PONTIAC, MICH.—The first car over the Pontiac & Sylvan Lake Electric Railway ran through the business portion of Pontiac on Sept. 30. Mayor Carroll acted as motorman.

OMAHA, NEB.—The proposition to vote $13,000 in bonds to aid in the construction of a street railway line from Ames Avenue, this city, to Florence, was carried by a vote of 131 to 31.

SHERBROOKE, QUE.—The Sherbrooke Electric Railway Company is applying to the legislature for a charter to construct and operate an electric street railway in Sherbrooke.

OTTAWA, ONT.—A few capitalists are looking into the possibility of forming a company to build an electric railway, to run from Ottawa to Morrisburg, via Eastman's Springs and Chesterville.

TORONTO, ONT.—The Electric Street Railway Company has constructed four special cars for handling big crowds. Each is equipped with a powerful motor capable of drawing a train of six trailers.

BROCKVILLE, ONT.—A company, to be called the Brockville Electric Railway, Company is being organized to build a street railway in Brockville and Elizabethtown. It will have a capital of $200,000.

ST. LOUIS, MO.—A survey is being made for an electric railway from Rinkleville to Ferguson, a distance of 10 miles, and it is understood that the St. Louis County Railway Company is interested.

CLEVELAND, O.— Permission has been granted the Cleveland and Elyria electric Railway Company by the county commissioners to construct two electric pumps under the South Rocky River Bridge.

OIL CITY, PA.—A charter has been granted to the Oil City Railway Station Company, John B. Smithman, president, and it is contemplated to build an electric line between Oil City and Franklin via the Deep Hollow route.

JOHNSTOWN, N.Y.—John J. Nellis in behalf of the Amsterdam Street Railway Company, has asked the Council for consent to build and operate an extension of the Amsterdam road from its present terminus at Akin, N. Y., into this city.

DETROIT, MICH.—The Detroit Railway Company a few days ago mandamused the Board of Public Works to compel the latter to grant certain permits for the laying of tracks. The permits were granted before the hearing took place.

UTICA, N. Y.—An application has been made to the Common Council, by the Utica Belt Line Street Railway Company, for permission to construct, maintain and operate extensions to its present street surface railway, on various streets of the city.

ALBERT LEA, MINN.—George C. Edwards, of Bridgeport, Conn., has been in this city negotiating for the putting in of a line of street cars to run in connection with the electric light plant, if an exclusive franchise for a long enough number of years can be secured.

SALT LAKE CITY, UTAH.—O. B. Hardy and W. J. Moorhead have asked the county court for a franchise to build and operate electric railways in the West Mountain mining district with headquarters at Bingham. The application was referred to the county attorney.

NEW BRUNSWICK, N. J.—The differences which have existed between the Raritan River Railway and the Brunswick Traction Company have at last been amicably adjusted and the work of extending the trolley system from this city to South River will be resumed at once.

QUEBEC, QUE.—Negotiations are in progress between H. J. Beemer and the Montmorency Electric Power Company for the purchase of all the latter's property and rights. It is said that it is this deal that has delayed the construction of Quebec's electric street railway.

MONROE, MICH.—The Monroe Electric Railway Company recently organized with a capital of $50,000, will build a road between Monroe and Dundee, 15 miles apart. H. Rauch, H. B. Bragdon, F. B. Strong, Fred H. Humphrey and H. E. Cowles, of Monroe, are among those interested.

PELHAMVILLE, N. Y.—The citizens of Pelhamville are circulating a petition for signatures, to be presented to the Union Electric Railway, asking that corporation to extend its line from Third Street, Mount Vernon, to Pelhamville. It is thought that the company will extend the line.

PITTSBURG, PA.—The contract for the building of the Knoxville, Fair Haven & Mt. Lebanon Street Railway has been let to J. J. Houghton, of Allegheny, at $161,000. The new line will be operated by the Pittsburg & Birmingham Traction Company, of which Henry Meuschke is president.

LOCKPORT, N. Y.—The differences between the Lock City Electric Railway Company and the New York Central concerning the crossing at Hawley Street have been settled. The work of crossing the tracks will be at once carried forward under the direction of the engineers of the two roads.

CHICAGO, ILL.—The charter of the Chicago City Street Railway Company has been filed. The company is organized with $5,000,000 capital stock to build, equip and operate railway lines in and about Chicago. The directors are A. J. Hawbe, F. A. Wheeler, T. A. Kane, A. W. Atterbury and C. A. Emons.

OXFORD, PA.—Col. Fell, of Wilmington, has been here for the purpose of ascertaining what encouragement would be given a company that would build an electric railway in this town and some of the neighboring towns in this section. A meeting of the Oxford Board of Trade will be held to discuss the subject.

HAGERSTOWN, MD.—The City Council, at a special meeting last week, was asked to grant a franchise to the Hagerstown & Potomac Railway Company to construct a street railway in Hagerstown. The company proposes building extensions of the road to Williamsport, Funkstown, Leitersburg and Waynesboro, to cost $100,000.

CLEVELAND, O.—Assurance has been given the Cuyahoga Suburban Railway Company, which will construct an electric line from Cleveland to Chagrin Falls, that a franchise will be granted the company by the Village Council of Chagrin Falls, and it is stated that work will begin at once on the line. Crosby Thompson is at the head of the enterprise.

WHITE PLAINS, N Y.—Quite a war was carried on between the employees of the White Plains Electric Railway Company and those of the Harlem River Railway Company on Friday of last week The *casus belli* was the attempt of the electric railway men to stretch a wire across the tracks. Peace was finally restored, and the trolley wire was hung in place just before night.

JERSEY CITY, N. J.—Chancellor McGill heard argument on last Monday in an application made by the Atlantic Highlands, Red Bank & Long Branch Electric Railway Company to dissolve an injunction preventing the road from running through Shrewsbury township. The people of the township are opposed to the route mapped out by the company. The chancellor refused to dissolve the injunction.

ORANGE, N. J.—The Maplewood & South Orange Railway Company began the operation of its new electric line between South Orange and Tremont avenues on Oct. 1. The power is furnished by the Suburban Traction Company, with which the new company will also have a traffic arrangement. As soon as the necessary franchise is granted the road will be extended to Valley Road and Forest Street.

CLEVELAND, O.—The county commissioners have decided to grant the Cuyahoga Suburban Electric Railway Company a franchise to construct a line from Randall to Lewis Corners, a distance of five miles. The railway company has already possession of a franchise to build from the terminus of the Broadway line on Niles avenue to Randall, and petitions the commissioners for permission to build to Chagrin Falls.

BROOKLYN, N. Y.—The Brooklyn Heights Railway Company has appointed about 50 inspectors to look after the passengers and see that motormen and conductors discharge their duties properly. The up-to-date management of this road has elicited considerable favorable comment. The company has completed arrangements to operate a trolley line from Fulton Ferry to Jamaica without change of cars for a fare of 10 cents.

BALTIMORE, MD.—The Baltimore county commissioners held a session last week to hear petitions asking for the granting of railway franchises in the 13th district. Applications to construct an electric railway on the Washington, Hollins' Ferry, Fishhouse and Annapolis roads have been made by the City & Suburban Company, the Columbia & Maryland Company and the Baltimore & Washington Turnpike & Tramway Company.

BROCKVILLE, ONT.—The Brockville Electric Railway, with a capital of $200,000, is applying to the Ontario Government for a charter to construct and operate a line of electric railway in the town of Brockville and in the township of Elizabethtown, Leeds County. The applicants of the charter are W. H. Comstock, C. S. Cossit, D. S. Booth, O. K. Fraser, G. I. Mallory, W. A. Galinour and M. M. Brown, all of the town of Brockville.

PHILADELPHIA, PA.—A trial trip and inspection of the new trolley mail route between the central office and Manayunk, and the cars which are to be used in the service, was made on Monday last by post-office officials and representatives of the Philadelphia Traction Company, over whose lines the new route has been laid out, and the new service began Tuesday. Two cars have been provided, which will make nine round trips per day over the route.

COLLINGSWOOD.—A petition is being circulated among the property owners, praying that the township authorities condemn land and open a street as far as West Haddonfield. This move, it is understood, is made in the interest of the Camden Horse Railway Company, and if such action is taken it will give the company an entrance into Haddonfield if the company so desires. The matter will be contested by property owners opposed to the opening of the street.

MILLVILLE, N. J.—A joint meeting of the Borough Councils of Anglesea, Wildwood and Holly Beach was held at Wildwood recently to consider the granting of a franchise for a trolley road between the three resorts. Two companies are endeavoring to obtain the right of way, and the Councils met for the purpose of forming a uniform ordinance for all three boroughs. Action on granting the franchise was postponed until next Saturday night, when an adjourned meeting will be held.

CHICAGO, ILL.—The General Electric Railway Company has given notice of an application for a franchise for a street car line through Fifty-sixth and Fifty-seventh Streets. The route is from Western Avenue, through Fifty-sixth and Morgan Streets to Fifty-seventh Street, and east on Fifty-seventh Street to Wabash Avenue. This cross-town line is intended as a feeder for the main lines of the company running from the heart of the business district southward, either on Dearborn Street or Wabash Avenue.

HAMILTON, ONT.—The Hamilton Radial Railway is making application to the City Council for free right of way on Cannon Street for the electric road from Majora Falls to Toronto. The directors say all they want from the corporation is this right of way, but no bonus. It is stated that the Hamilton company has closed a contract with the Niagara Power Company which makes the construction of the road a certainty. The company has abandoned the steam railway part of the enterprise and will build an electric road. It is asking the city for right of way along Sherman Avenue also.

THE DELAWARE & HUDSON RAILWAY COMPANY calls the attention of delegates and others who propose to attend the convention of the American Street Railway Association at Montreal to the fact that the Delaware & Hudson Railway is in every way a desirable line between New York and Montreal. It is 20 miles shorter than the Central Vermont, and 90 miles shorter than the New York Central line via Utica. The road, power and equipment are maintained at the very highest standard. Every mile of the journey is attractive. The line passes through Saratoga, and skirts the western shore of Lake Champlain for its entire length, in full view of the Adirondack and Green Mountain ranges. Through sleeping cars leave Grand Central station, New York, at 7 p. m., and arrive in Montreal 8.00 a. m. The day train leaves Grand Central station at 9.30 a. m., connecting at Albany with the Montreal express and arriving in Montreal at 9.50 p. m, Returning, the day train will leave Montreal 9.10 a. m., and arrive in New York 8.45 p. m. The sleeping car train will leave Montreal at 6.10 p. m. and arrive in New York 6.45 a. m. The rates for the convention are one fare and a third for the round trip on the certificate plan.

BROOKLYN, N. Y.—For the last week the Nassau Railway Company has had quite a fight to get tracks laid on Ocean Avenue across the Manhattan Beach Railway Company's road. A week ago the contractors, with a large gang of men, forced their way over with a car, and after that succeeded in getting several cars across, so as to do quite a business on Sunday. During the greater part of last week cars were operated as far as the Manhattan Beach tracks, and then passengers were transferred to cars on the other side, because the crossings were not in place. At a late hour on Thursday night, however, the Nassau Company completed the laying of tracks for its Sheepshead Bay line over the Long Island tracks at Ocean Avenue. although some hours previous the Long Island Railway Company had secured a temporary injunction from Justice Pratt. When the matter came before the court the latter company withdrew its objections, with the understanding that the Nassau Company would place three flagmen at the crossing to prevent a possible collision between the trolley cars and the Manhattan Beach trains. The Nassau Company agreed to this proposition, and this ended the fight between the rival companies. Cars from Broadway ferry and from Thirty-ninth Street ferry to Coney Island now carry people without a change for five cents.

PERSONAL NOTES.

MR. JOHN CAMERON, formerly one of the superintendents of the Brooklyn Heights Railway Company, has accepted the position of superintendent of the Atlantic Avenue Railway Company, of Brooklyn.

MR. W. E KEILY, of the *Western Electrician*, was married to Miss Catherine Meagher, of Chicago, on Sept. 21. The many acquaintances in the electrical fraternity of Mr. Keily will join us, we feel sure, in wishing the happy couple many joyful years of connubial bliss.

MR. HENRY C. PAYNE, of the Milwaukee Street Railway Company, has resigned his position as one of the receivers of the Northern Pacific Railway Company. It was thought more than likely that one of the new receivers would be another street railway man, Mr. Thomas Lowry, of the Twin City Rapid Transit Company, of Minneapolis, but the court made a different choice.

DR. FREDERICK BEDELL, of Cornell University, arrived in New York on Saturday, Sept. 28, having returned from a several months' stay in Europe. Dr. Bedell attended the meeting of the British Association at Ipswich, and had the honor of being invited to sit with the committee on magnetic units, among whose members were Kelvin, Rayleigh, Ayrton, S. P. Thompson, Lodge and Everett.

MISCELLANEOUS NOTES.

THE BROOKLYN ELECTRICAL SOCIETY began its lecture course for the season of 1895-96 on Tuesday evening, Oct. 1. The lectures during the month will be held on Tuesday evenings of each week, in the Edison Assembly Rooms, No. 370 Pearl Street. Information concerning the society can be had by addressing Arthur A. Fish, corresponding secretary, No. 370 Pearl Street.

THE CORRESPONDENCE SCHOOL OF TECHNOLOGY.—The incorporation of the Correspondence School of Technology, Cleveland, O., has been consummated, with Prof. E. P. Roberts as president; Thomas Robinson, treasurer, and J. C. Gallup, secretary. The school is in better condition than ever before, financially and otherwise, two courses and two instructors having been added. The courses taught by the school are, (1) Electrical Engineering, (2) Steam Engineering, (3) Bridge and Roof Construction, etc., (4) Civil Engineering, (5) Mechanical Engineering, (6) Hydraulic Engineering, and (7) Higher Mathematics.

TRADE NOTES.

CHARLES J. MAYER, Betz Building, Philadelphia, representing the R. D. Nuttall Company in the Middle States, and also carrying a large line of railway supplies on his own account, will attend the Montreal convention in behalf of the Nuttall Company and also in his own interest. Mr. Mayer reports business very gratifying.

THE EDDY ELECTRIC MANUFACTURING COMPANY, of Windsor, Conn., has appointed as its Western agents J. B. Wallace and W. S. Hine, with headquarters at 305 Dearborn Street, Chicago. The Eddy Company possesses now an excellent agency corps, its business has increased wonderfully, and still continues to increase at a rate which surprises even its popular and able management.

LINTON & SOUTHWICK, of Worcester, Mass., the well-known switch manufacturers, have opened a Boston office at the office of the Shawmut Fuse Wire Company, 93 Federal Street, which is a move in the right direction. This energetic firm's factory has for some time been kept very busy in filling orders, rendering necessary an increase of working force and the running of the factory up to 10 o'clock at night.

THE STANDARD PAINT COMPANY, of No. 2 Liberty Street, New York, owing to the increased demand for "P. & B." products abroad, has found it necessary to establish headquarters of its own in England, and to that end President Shainwald sailed from here on the *St. Louis* on Wednesday, Sept. 25. Mr. Shainwald contemplates spending two or three months abroad and expects to establish agencies for the sale of "P. & B." products in all the principal foreign cities.

A. L. IDE & SON, of Springfield, Ill., have added to their long list of bright advertising ideas a pack of playing cards which are ornamented on the backs with engravings representing Ideal engines. Those of the electrical trade who are fortunate enough to receive one of these very handsome packs should certainly appreciate the favor. The large number of Ideal engines in electrical service would indicate that Messrs. Ide & Son's artistic and original advertising devices have not failed in the mission for which they have been so well designed.

MR. C. J. O'HARA, secretary of the Austin Separator Company, Detroit, Mich., who has been spending a well-earned vacation in the wilds of Rhode Island, has abandoned rubber boots, rod and gun and returned to Detroit, in better trim than ever before to demonstrate the merits of the Austin Separator. Mr. O'Hara reports that the business being done by his company at present is entirely satisfactory, new orders coming in from all parts of the country and second orders and merited testimonials being received from former purchasers.

MR. E. W. LITTLE, general manager of the Interior Conduit & Insulation Company, of New York, will be present at the coming convention of the American Street Railway Association at Montreal, where he will treat the delegates to a complete and comprehensive exhibit of the Interior Company's new underground feeder system for street railway service. The well-earned reputation enjoyed by Mr. Little and his company for progressiveness and thoroughness in whatever they undertake is a guarantee that the promised exhibit will be not only interesting but instructive.

THE W. C. LEFFEL COMPANY, of Springfield, O., has been reorganized with a capital stock of $100,000 and will hereafter be known as the Trump Manufacturing Company. The new officers are as follows: President, John J. Hoppes; vice-president, Wm. Conklin; general manager, Fuller Trump; treasurer, Paul A. Staley; secretary, Percy Norton. The directors in addition to the officers are J. A. Hayward, Horace Keifer, Frank Bartholomew, G. P. Frank and J. L. Barger. The company proposes to begin work at once and special attention will be paid to the manufacture of the Fuller Trump water wheel.

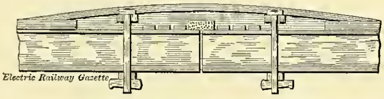
THE AMERICAN WHEELOCK ENGINE COMPANY'S WORKS, at Worcester, Mass., is a perfect beehive of activity at the present time, being taxed to its utmost capacity up to 9 o'clock at night, and we are informed by Assistant General Manager Hardy that the Philadelphia and Milwaukee works are equally busy. But few concerns can boast of so strong an executive management as can this company. As is now quite well known, Mr. Edwin S. Cramp, of Philadelphia; Mr. J. H. Hoadley, of Hoadley Brothers, the well-known engineers of Chicago, Ill., and Mr. E. K. Hill are its permanent officials, and the company represents the consolidation of several important interests, and controls a number of strong engine patents.

THE ELECTROMAGNETIC TRACTION COMPANY, of Philadelphia, will be represented at the Montreal convention of the American Street Railway Association by the following: J. F. McLaughlin, inventor of the system; George Lodge, general manager; Charles L. Smith and Andrew Adie, of Scotland. The Company made the first test of its system on Wednesday at the corner of York and Sedgeley Avenues, Philadelphia. The test was made on a track 1,000 feet in length, and the car was operated with entire success and without a hitch of any kind. The promoters and officers of the company, who witnessed the test, were greatly pleased with the result. The company is now erecting an immense building for the purpose of manufacturing apparatus.

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED SEPTEMBER 24, 1895.

546,691. CONTINUOUS-CURRENT RECTILINEAR MOTOR; Clinton E. Woods, Chicago, Ill., assignor by direct and mesne assignments to the C. E. Woods Company, same place. Filed April 6, 1895. A number of polar projections or poles of alternate polarity are situated along the line of travel. A magnetic core is mounted upon the vehicle, with its axle parallel to the line of travel. The core is wound with a number of coils which are connected together end to end so as to form a closed circuit. The ends of the coil are respectively connected to the segments of a commutator upon the surface of which brushes connected with a source of electricity bear so that current is directed through the coils to produce changing poles on the magnetic core adapted to react upon the poles situated along the line of travel to propel the vehicle forward.



NO. 546,773.—CLAMP FOR USE IN WELDING RAILS.

546,773. CLAMP FOR USE IN WELDING RAILWAY RAILS; William M. Brown, Johnstown, Pa., assignor to the Johnson Company, same place. Filed June 24, 1895. This is a clamp for railway rails and comprises a body portion with sloping track surfaces adapted to align with those of the rails and overhanging portions on each side of the track surfaces together with clamping members passing beneath the rail and engaging the overhanging projections. (See Illustration.)

546,774. CAR TRUCK; Edward Cliff, Newark, N. J. Filed June 22, 1895. This is a combination with the frame and axles and wheels of an elliptic spring on each side of the frame midway between the axles and having its upper half heavier than the lower half. Levers are fulcrumed intermediate their length on the ends of the axles and have their inner ends connected to the centre of the lower portion of the spring with connections between the ends of the springs and the levers.

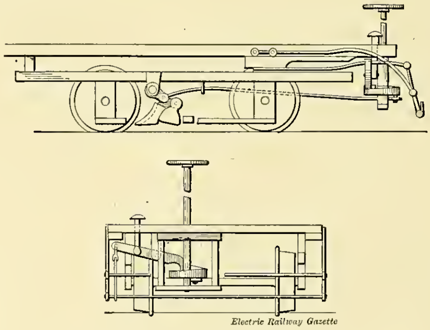
546,797. CAR FENDER; William E. Woodbridge, Washington, D. C. Filed Dec. 1, 1894. The fender comprises a swinging cradle having downwardly curved spring arms and resilient bearings or abutting points composed of projecting loops intermediate to the arms, and connecting each arm with the arms adjacent to it on either side.

546,798. CAR FENDER; William E. Woodbridge, Washington, D. C. Filed May 17, 1895. The fender comprises suspension springs resilient in the direction of the motion of the car and a suspended swinging cradle supported by the springs. There are intermediate abutting arms between the springs and the cradle.

546,808. AUTOMATIC CAR BRAKE; Christina Brandau, Cohoes, N. Y., assignor of one fourth to Frank P. Higby, same place. Filed July 10, 1895. A sectional shoe is mounted on a rocking shaft, and a collar on the shaft has connection with a wheel having a spirally inclined upper surface and mounted on a vertical shaft provided with a hand wheel. A spring actuated dog is pivoted to a portion of the car, and is adapted to engage with a shoulder on the inclined surface of the wheel. There is a push rod pivoted to the dog, so that the brakes are set by gravity when the dog releases the wheel. (See Illustration.)

546,837. INSULATING SUPPORT FOR ELECTRIC WIRES; Jos. N. Bulkley, Ridgway, Pa., assignor to the General Electric Company, of New York. Filed March 4, 1895. An insulating support for electric trolley wires, consisting of an insulating bar adapted to support a bracket for the wires, in combination with a ceiling or other solid support provided with holes; bolts passing through said insulating bar and projecting into said holes, and wedge-shaped sections of a tube located in said holes, said wedge-shaped sections being diagonal from end to end and overlapping each other in wedging relation, and the lower wedge-shaped tubular section projecting from said hole and abutting against the insulating bar, and means on the outer end of said bolts for tightening up the said bar against the lower wedge-shaped tubular sections and wedging then into said holes.

546,928. OVERHEAD RAILWAY WITH SUSPENDED VEHICLES; Eugen Langen, Cologne, Germany. Filed July 16, 1894. This is an overhead railway with the vehicles suspended. The truck frame is supported by wheels on the rails and is composed of side frames connected by transverse pieces, of which one carries safety supports and is adapted to come in contact with the rails, while another carries safety rollers adapted to bear against the under sides of the girders of the structure. A swiveling bolt is suspended from the last named transverse piece and serves as a means of suspension for a transverse bearer from which the car body is hung, and rollers carried by this bearer are adapted to press against the under side of the same transverse piece of the frame.



NO. 546,808.—AUTOMATIC CAR BRAKE.

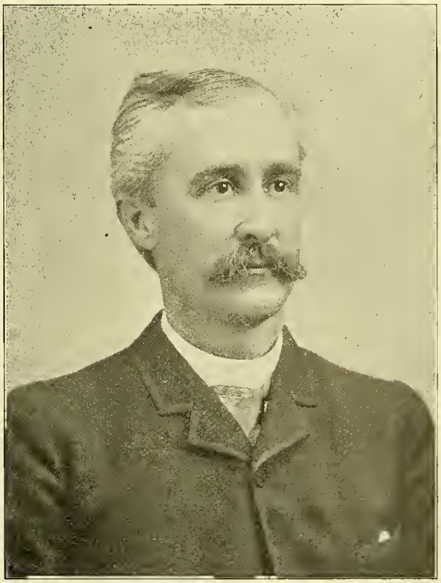
546,962. CAR FENDER; Eben J. McLaughlin, Essington, Pa., assignor of one half to Irwin W. Duncan, same place. Filed Jan. 5, 1895. The fender is formed of a body having depending arms and cross slats are connected therewith. There are a support and brace between the ends of the arms consisting of cross bars, and bolts are attached thereto, the arms freely occupying the spaces between the bars and bolts,

Electric Railway Gazette.

Vol. XIII. NEW YORK, OCTOBER 12, 1895. No 15.

American Street Railway Association.

The convention of the American Street Railway Association, at Montreal, Oct. 16, 17 and 18, will be the fourteenth annual meeting of the organization. The history of the Association covers the entire interesting period in the development of the street railway. Prior to its formation scarcely any radical changes in local transportation methods had appeared since the first street railway had been constructed. Improvements had been introduced, but if the progress was sure it was exceedingly slow, and for some years was scarcely perceptible except in matters of detail. During the years, however, that the Association has been in existence, the street railway has been subjected to the most extraordinary changes; indeed, it would not be easy to point to another industry which has been so completely revolutionized within the same length of time.



JOEL HURT, PRESIDENT OF THE AMERICAN STREET RAILWAY ASSOCIATION.

The street railway, as known at the time the Association was formed, is now out of date. It has not wholly disappeared, but it is no longer regarded as a suitable means of urban or suburban transit, and the substitution of something better in the near future is confidently expected wherever it is found. The topics once discussed at the street railway conventions are now regarded as obsolete, and a wholly new order of subjects has taken their place. While retaining its old name the Association has become a wholly different body, dominated by new ideas and following new lines of activity. It is interesting to note, however, that many of those prominent in the councils of the Association in the old days are still at the head of affairs in the street railway world to-day. It speaks well for the capability of street railway men that they have in so many cases been able to adjust themselves to the new order of things, and have successfully assumed duties in connection with complex mechanically operated transportation systems, for which their previous experience in charge of the comparatively simple horse railway properties could scarcely have qualified them.

From the time it was formed the Association has served a most useful purpose, and during the last few years of its history it has conferred the greatest benefit upon its membership. The days of transformation in the street railway field were to a very large extent days of experiment. The necessity for obtaining the results attending the use of various kinds of apparatus and for securing accurate knowledge regarding methods of operation was keenly felt. The conventions were greatly instrumental in meeting the demand for information. They afforded opportunities for the interchange of experiences, furnished, through papers read at the meetings, practical information obtainable only with the greatest difficulty through other channels, and of the utmost value to those engaged in the operation of electric roads. Each year the usefulness of the Association has become more apparent, and an increasing significance attaches to its meetings which have become the most important events in the street railway calendar. The problems have not all been solved, and a vast deal of important work still remains to be done. New plans for increasing the activity of the Association in certain directions are now under consideration, which, it is believed, will make it of even greater benefit to the street railway interest as a whole.

It does not appear that the organizers of the Association realized at the outset that they were so soon to enter upon a period of development during which a body formed for the discussion of topics of mutual interest would prove especially useful. They had simply reached the conclusion that the time had arrived when the street railway industry had attained sufficient importance to justify the formation of a representative organization. It is generally agreed that to Mr. D. E. Longstreet, now of Denver, is due the credit for the original suggestion that an association of street railway men should be created. He interested in the project Mr. H. H. Littell, Mr. Henry L. Watson, Mr. Walter A. Jones, Mr. Thomas Lowry and Mr. J. E. Rugg. Mr. Littell, then of the Louisville City Railway, and now of the Buffalo Railway Company, issued the call for the first meeting, which was held Dec. 12, 1882, at Young's Hotel in Boston.

It is worthy of note that it was decided at the first meeting to style the Association "American," so that the Canadians, who are now to entertain the Association, might be eligible for membership. The election of officers resulted as follows: President, H. H. Littell, Louisville; first vice-president, William H. Hazzard, Brooklyn; second vice-president, Calvin A. Richards, Boston; third vice-president, George B. Kerper, Cincinnati; and secretary and treasurer, William J. Richardson, Brooklyn. At each succeeding meeting Mr. Richardson was re-elected to office and he performed his duties with rare fidelity and enthusiasm until April last, when the members of the Association were shocked by the news of his death. With his demise one of the most familiar figures in the Association, and one of its most interested and useful members, passed away. The choice of a successor to Mr. Richardson will be one of the important matters to come before the convention at Montreal.

W. WORTH BEAN, FIRST VICE-PRESIDENT OF THE AMERICAN STREET RAILWAY ASSOCIATION.

The Association held its second meeting in Chicago in 1883. Among the subjects which were discussed at that time was "Horse Shoeing"—a topic which would scarcely interest a single member at the present time. The cable system was also considered, and it is interesting to find that the committee which reported on the subject reached the conclusion that "the only practical means as yet presented to our view for dispensing with animal power is the cable system." In his inaugural address, the president voiced the wishes of the members for a better motive power for street railways than was then available, and he looked ahead to the time when electricity should be used. He said: "I see in the recent subjugation of the subtle and hitherto illusive force of electricity to the needs of man boundless possibilities for the world's three great requisites for advancement—heat, light and power. The crude experiments already made with electricity as a motive power for propelling cars in lieu of steam or horsepower clearly foreshadow the inevitable application of the new motor to our immediate interests."

At the third meeting which was held in New York City, October, 1884, the membership represented 74 companies. Among the subjects discussed were a number which are now of prime interest, including such topics as "Complete Track Construction," "Repairs of Track," "Track Cleaning and Use of Salt in Removing Snow and Ice," "A Uniform System of Accounts," "Ventilation, Lighting and Care of Cars." But all of these matters were treated from points of view so radically different from those assumed at the present time that the information elicited is by no means applicable to existing conditions. In the discussion of track construction, for example, the relative merits of steel and iron rails were considered and the question whether girder rails were the most desirable type was considered. These questions have long ago been definitely settled. The question of electricity as a motive power was also taken up, and a most interesting address on this topic was made by Calvin Richards, of Boston, who predicted that the next step in street railway progress would be the adoption of electricity. He said he had been urged to use the cable system and steam engines, but he remarked, "all I have to say on electricity as a motive power is, wait."

The fourth and fifth meetings of the Association were held, respectively, in St. Louis and Cincinnati in 1885 and 1886. No topics of great interest were discussed. The horse came in for a proper share of attention, but in Cincinnati the cable system then in operation attracted no little interest.

At the sixth meeting, in 1887, in Philadelphia, the subject of electricity was again considered, and its discussion occupied a prominent part in the proceedings. Two subjects that have since become familiar were brought to the attention of the delegates. These were the formation of a mutual street railway fire insurance company and the admission of supply men as associate members. No definite action was taken on either question.

In 1888 the question of electric traction became a matter of vital concern to the members of the Association. The Richmond electric railway had been put in operation, and it was realized that at last electric traction was becoming a practical means for the operation of street cars. At this convention representatives of electric companies were present and took part in the proceedings and an exhibit of apparatus was made.

The eighth convention was held in Minneapolis in 1889. The membership had now increased to 106 companies. For the first time the question of electric traction came before the Association in a practical way, and data illustrating the results of an electrical system of operation were presented. It was realized at this meeting that electric traction had come to stay, and that street railways in the future would be electrically operated.

JOHN H. CUNNINGHAM, SECOND VICE-PRESIDENT OF THE AMERICAN STREET RAILWAY ASSOCIATION.

The meeting at Buffalo in the following year assumed the character of the conventions as they are now conducted. An extensive exhibit of electrical apparatus and supplies of various kinds was made, a large delegation of street railway representatives and supply men was in attendance, and the utmost interest was taken in the proceedings. President Lowry made at this time a prediction that time has verified. He expressed the confident belief that the Buffalo meeting would be the last at which the horse would be seriously considered as a means of operating cars.

RUSSELL B. HARRISON, THIRD VICE-PRESIDENT OF THE AMERICAN STREET RAILWAY ASSOCIATION.

With the conventions which have since been held the great majority of those engaged in the street railway field are generally familiar. The tenth meeting was held in Pittsburg, the eleventh in Cleveland, the twelfth in Milwaukee and the thirteenth in Atlanta. At all these gatherings the attendance has been large, the proceedings have been of high practical value, and the exhibits of street railway apparatus and supplies of every kind have been extensive and interesting. The Association in these years has been gradually changed from a body interested in the development of various types of traction systems to one devoted almost exclusively to one of the practical sides of electricity. If its name were changed to the American Electric Railway Association, the new title would more closely define the existing organization.

The present officers of the Association are as follows: President, Joel Hurt, Atlanta; first vice-president, W. Worth Bean, St. Joseph, Mich.; second vice-president, John H. Cunningham, Boston; third vice-president, Russell B. Harrison, Terre Haute; executive committee, the president, vice-presidents and Henry C. Payne, Milwaukee; William H. Jackson, Nashville; D. G. Hamilton, St. Louis; Granville C. Cunningham, Montreal, and John N. Partridge, Brooklyn.

American Institute Meeting.

On account of the Montreal Convention of the American Street Railway Association the monthly meeting of the American Institute of Electrical Engineers has been postponed from Oct. 16 to Oct. 23.

Programme of the Montreal Convention.

The programme of the Montreal Convention of the American Street Railway Association is presented herewith. The call for the meeting provides for a four-day session, but the committee in charge at Montreal is not satisfied with so limited a stay of the visitors, and has arranged for their entertainment on a fifth day, as will be seen by the following programme:

FIRST DAY, TUESDAY, OCT. 15.

The convention will be called to order in Windsor Hall at 10 a. m. An address of welcome will be delivered by Mayor Villeneuve, of Montreal. The following subjects have been arranged for discussion: "Transfers," "Municipal Ordinances," "Labor Question: Wages Paid to Employees," "Experience of Roads in Furnishing Free Music and Other Entertainments to the Public," "Physical Operation of Roads."

The exhibit of street railway supplies and apparatus in Victoria Rink will be open the entire day and until 10 p. m. during the convention.

SECOND DAY, WEDNESDAY, OCT. 16.

The convention will be called to order in Windsor Hall at 10 a. m.

A reception will be tendered the delegates by the governors of McGill University, in the Engineering Building, at 3 p. m. The electrical machinery and testing apparatus will be shown in operation. All visitors and ladies attending the convention are invited.

THIRD DAY, THURSDAY, OCT. 17.

The convention will be called to order in Windsor Hall at 10 a. m.

A special trip has been arranged over the street railway systems of the Montreal Street Railway Company and the Montreal & Island Railway Company, and a visit will be made at the power-house and shops of the former company. Special cars will start from the Windsor Hotel at 2:30 p. m.

[Note.—During the convention all those wearing convention badges will be carried free on the cars upon showing badges.]

The annual banquet of the Association will be held in the Windsor Hotel at 7.30 p. m. Those intending to be present are requested to give their names and secure tickets, without delay, at the information bureau in the Windsor Hotel.

FOURTH DAY, FRIDAY, OCT. 18.

The convention will be called to order in Windsor Hall, at 10 a. m. A secretary of the Association will be elected, and a place of meeting for 1896 will be selected. Closing exercises.

During the convention delegates and their friends are invited to visit the Kermesse in the Drill Hall, Craig Street, held in aid of the Notre Dame Hospital.

GRANVILLE C. CUNNINGHAM, MONTREAL MEMBER OF THE EXECUTIVE COMMITTEE OF THE AMERICAN STREET RAILWAY ASSOCIATION.

SATURDAY, OCT. 19.

A trip to Ottawa, by special train on the Canadian Pacific Railway, will be tendered to members of the Association by Mr. James Ross, vice-president of the Montreal Street Railway Company. The party will be taken over the Ottawa Street Railway system and will be received in the Senate chamber of the Parliament Buildings. Luncheon will be served in the Russell House, and the return to Montreal will be made in time to catch the outgoing evening trains to Boston and the West. The special will leave Montreal at 7.30 a. m., returning at 7 p. m. Members of the

Association who accept Mr. Ross's invitation will give their names and those of the ladies accompanying them, to the information bureau in the Windsor Hotel not later than noon on Thursday, so that cards may be given and arrangements completed.

Members of the Association who desire to see or join the fox hunt are invited by Mr. L. J. Forget, president of the Montreal Street Railway Company, to a hunt breakfast at his country home, near Ste. Anne's. A train will leave by the Grand Trunk Railway, from the Bonaventure station at 9 a. m. Members who can accept this invitation will give their names at the information bureau.

Montreal Street Railway Convention Notes.

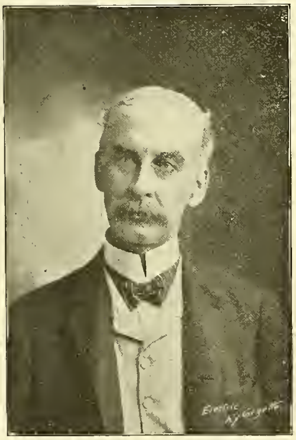
The Baltimore Car Wheel Company, of Baltimore, Md., will be represented by the secretary, J. Paul Baker.

Mr. W. J. Tremper, of Lancaster, Pa., will be present at the convention, and will exhibit a model showing the points of excellence in the Tremper universal snow-plow.

The Drummond Detective Agency, of New York City, will be represented by George E. McOmber, late chief clerk of the United States Secret Service of the Treasury Department.

Morris, Tasker & Company, of Philadelphia, whose goods are known throughout the street railway field, will be represented by H. C. Vansant, secretary, and Charles Y. Flanders.

The Allerton Lubricant Company, of Chicago, will be represented by C. J. Seeber. The company will show samples of lubricating oil and greases for electric railway use, of which it makes a varied supply.



D. G. HAMILTON, OF THE EXECUTIVE COMMITTEE OF THE AMERICAN STREET RAILWAY ASSOCIATION.

The John Stephenson Company, of New York, will be represented at the convention by Daniel S. Pugh and John S. Pugh, who will be able to supply all desired information regarding improved car construction.

The Cutter Electrical and Manufacturing Company, of Philadelphia, will be represented at the convention, and will make an exhibit of its circuit-breakers, which are now so well known in street railway power stations.

The Partridge Carbon Company, of Sandusky, Ohio. will be represented by James Partridge, manager. It will show samples of the carbon goods manufactured by the company which are designed for electric railway service.

The Brooklyn Railway Supply Company, of Stamford, Conn., will be represented at the convention by Charles B. Allyn, secretary and treasurer, and E. P. Avery, who will explain to visitors the meritorious features of the company's devices.

The Badger Manufacturing Company, of Milwaukee, will make an exhibit which will be in charge of George Whyte. It will include a full line of overhead railway material, which is bound to attract the attention of practical railway men.

The Simonds Manufacturing Company, of Pittsburg, Pa., will be represented by the president, Mr. Biddle Arthurs, who will call the attention of delegates to some interesting facts in connection with trolleys, trolley wheels, gears, pinions, etc.

The E. T. Burrowes Company, of Portland, Me., will, as usual, make an attractive exhibit of the Burrowes automatic car curtains for closed street railway cars. A full line of car curtain samples of every kind will also be exhibited. H. H. Russell will be in charge.

The Stirling Company, of Chicago, will not make an exhibit of its boilers, but will be represented by F. A. Scheffler, the New York representative, who will be able to present statements of the excellent results attending the use of Stirling boilers in railway power stations.

Mr. C. W. Henderson, of Montreal, will make an interesting exhibit. Among some of the specialties which he will show will be a signal system for power stations, telephones for railway lines, factories and office use, car fittings and general electrical supplies.

The Mica Insulator Company and Eugene H. Munsell & Co., of New York, will exhibit a line of micanite in its various forms, for street railway motor insulation. It will also include mica cut to patterns in the shape of segments and rheostats. Their representative will be Charles E. Coleman.

The Paige Iron Works, of Chicago, will be represented by E. S. Nethercut, the company's engineer. The company will probably not make an exhibit, but will have headquarters where its friends will be received. Probably plans of some of the special track work for which the company is famous will be shown.

The John A. Roebling's Sons' Company, of Trenton, N. J., will show samples of its wires for street railway work. One of its interesting exhibits will be a wire of special section, which has been successfully used on the Nantasket Beach electric road. Mr. Doyle and Mr. Cockey will represent the company.

Mr. Theophile Euphrat, of Darien, Conn., will attend the convention, and will exhibit some of his specialties in trolley wheels, as well as his improved trolley ice cutter. Mr. Euphrat's latest invention is a combination housing harp and trolley wheel, which is automatically lubricated. It is a device well worthy of examination.

The Ohio Brass Company, of Mansfield, Ohio, will be represented by C. K. King, manager of the electrical department, and J. F. Macartney, Eastern agent. The company will show a full line of its construction material and line devices which are now so well known throughout the country, and will also have some interesting novelties.

The Akron Insulator & Marble Company, of Akron, O., will make an exhibit of its standard bushings for electric wiring purposes, insulators, cleats, circuit-breakers and other specialties. These goods are now well known, and Mr. Daniels, the company's representative, will find a great number of persons interested in these articles at Montreal.

The Charles Scott Spring Company, of Philadelphia, will be represented by Charles Scott, Jr., Harry C. Johnston and William H. Hansell, the general manager of the street railway department. The exhibit which the company will make will include samples of the great variety of springs for every kind of street railway service which it manufactures.

The Fulton Truck & Foundry Company, of Mansfield, O., usually has on exhibition at conventions appliances in which street railway men take an interest, and probably no deviation from this custom will be made at Montreal. Mr. W. E. Haycox, the president and general manager, who is a practical street railway man, will represent the company.

The Goubert Manufacturing Company, New York, will be represented by H. M. Montgomery and Frank A. Thayer. The company will make an exhibit of models of the Goubert feed-water heater, and of the Stratton steam separator, and its representatives will see to it that the merits of these well-known adjuncts of a well-equipped power station are properly emphasized.

The Standard Air Brake Company, of New York, will be represented by its superintendent and general manager, E. J. Wessels. The company has recently sold to the Montreal Park & Island Railway Company ten air brakes. The demand for better brakes is now so pronounced that the Genett representatives will find many who are in search of information in its special line.

The Pettingell-Andrews Company, of Boston, will have on exhibition a full line of the varied assortment of supplies which it carries. The company is the selling agent for the overhead material and commutator segments made by the Billings & Spencer Company, at Hartford, and will also show samples of these goods which have given satisfaction in so many quarters. Mr. C. B. Price, general manager, and Mr. Frank X. Cicott, will represent the company.

The Fuel Economizer Company, Matteawan, N. Y., will be represented by the general manager, A. H. Blackburn. The company will not make an exhibit, but will do what it considers far more important, that is, call attention to its economizer in the power-house of the Montreal Street Railway Company, as well as those in use in several large manufactories in the city. The results attending the use of the economizer in railway power plants have proved highly satisfactory.

The Consolidated Car Heating Company, of Albany, will, as usual, make an interesting exhibit. The company will show half of a car seat, with heaters in place, and will also exhibit its different types of electric heaters for cars. There will be placed in its space boards fitted with incandescent lamps, illustrating the action of the regulating switches. The company's representatives will be James F. McElroy, consulting engineer; H. N. Ransom, selling agent, and W. P. Cosper, Western agent.

The Prouty-Noble Automatic Brake Company, of Chicago, will be represented by Mr. E. J. Noble. The company, just at the present time, is busily engaged in equipping Chicago cars with its automatic brake. It is being applied to cars of the Chicago City Railway Company, and recently an order was received for the equipment of 300 cars of the North Chicago Railway Company with its tunnel emergency brake. The brake adds an element of safety, the value of which cannot be overestimated.

The American Rail Joint & Manufacturing Company, of Cleveland, O., will exhibit a full line of Bartholomew rail joints, the use of which, it is claimed, solves the difficulty which has everywhere been found vexatious. The exhibit will include rail joints designed for use by both electric and steam roads, the T-rail joint for standard steam railway construction, as well as the latest type of girder rail joint designed for use with and without chairs, and also that designed for a nine-inch girder rail.

The H. W. Johns Manufacturing Company, of New York, will be represented at the convention by Mr. Henry G. Issertel and Mr. Hatch, from the Johns-Pratt branch, in Hartford, Conn. These gentlemen will exploit the merits of the company's moulded mica railway insulating material. They may not find it an easy matter, however, to discover persons who are unfamiliar with this standard overhead material, which has given such excellent results under all conditions in all parts of the country.

The Johnson Company, of Lorain, O., will be represented as usual by a number of its agents. The Johnson girder rails are so well-known, in fact are adopted as standard in so many places, that the company has determined that no formal exhibit is necessary; at the same time, the agents can be depended upon to produce models of sections of rails when occasion demands. They will doubtless also be able to give some timely information on rail welding, in which every one is interested at the present time.

The Falk Manufacturing Company, of Milwaukee, Wis., will be represented by E. A. Wurster, secretary and treasurer, who will show samples of the cast-welded rail joints made by the company. The company has already welded over 100,000 joints in Chicago, and contracts have been entered into at St. Louis, Newark, Minneapolis and St. Paul. At the present time six machines are in operation in St. Louis, where only three joints broke out of a total of 788 last Winter, and since that time no breaks have occurred up to the present time.

The Standard Underground Cable Company will be represented by Mr. G. L. Wiley, of New York, Eastern manager, and Mr. James R. Wiley, of Chicago, Western manager. The exhibit will include aerial and underground wires and cables, and especially street railway feeder cables. In the main, it will consist chiefly of samples cut from cables in actual use by street railway companies throughout the country, and the company by which each one is used will be indicated. The company is doing a large business with street railway companies at the present time, and much interest will be taken in its exhibit.

The Griffin Wheel Company, of Chicago, will be represented by A. G. Wellington, W. F. Newbert and C. K. Knickerbocker. While the company will make no exhibit, its representatives will be able to give some interesting information regarding the use of Griffin wheels by electric railway companies. It has been well said that the merit of a wheel can be shown only by the test of actual service. The Griffin Company's wheels have certainly stood this test successfully, as is shown by the fact that while the company had in operation prior to June of this year the largest wheel factory in the country, yet it was obliged by constantly increasing business to build an addition, increasing its capacity one third.

The Fiberite Company, of Mechanicsville, N. Y., will have on exhibition some interesting samples of its varied assortment of street railway appliances. The exhibit will include almost everything pertaining to overhead equipment and switchboard work, and will comprise, among other things, aluminum-bronze overhead trolley equipment, including straight line hangers, pull-offs, ears, feed wire insulators, globe strain insulators, bracket hangers, and also a full line of West End straight line hangers, bridge insulators, car house insulators, trolley harps and wheels, splicing sleeves, waterproof wall sockets, quick break switches, slow break switches and Medbery "pony" switches. Mr. H. J. Medbery, Mr. W. R. Mason, Chicago; Mr. John B. Hoefgen, of Hoefgen, Moxham & Co., New York; Jacob Wendell, Jr., and R. L. MacDuffie, New York, will be the company's representatives.

The Walker Manufacturing Company, of Cleveland, O., will make an exhibit which will illustrate its electric railway system. Two trucks will be shown with the latest type of motors mounted thereon. An interesting part of the exhibit will be one of the company's standard switchboards, containing two generator panels and two feeder panels, with the necessary instruments. A 25-hp railway motor will also be shown open so that it may be readily inspected. A number of motor armatures will also be exhibited, in order that the method of winding may be clearly shown. The exhibit will also include a number of miscellaneous appliances, such as switches, cut-outs, etc., designed for railway work, and all of the details of its apparatus will be shown by a collection of photographs. The company will be represented by Mr. Frank Billings, president; Mr. S. H. Short, second vice-president; Mr. W. H. Bone, manager; Mr. R. N. Baylis, electrical engineer; Mr. H. McL. Harding, Mr. B. M. Barr and several of its agents in different cities.

The J. G. Brill Company, of Philadelphia, will charter a special car for Montreal, and the representatives of the company will be accompanied by a large number of friends. The train will leave Philadelphia, Sunday afternoon, at 3:45 p. m., by the Reading Railway. The following evening will be spent in New York. On Monday, at 9:30 a. m., the train will leave for Montreal via the D. & H. Ry. The list of passengers, so far as can be learned, is as follows: J. A. Brill, M. E. Curwen, Samuel Curwen and W. H. Henlings, Jr., of the J. C. Brill Company; J. H. Carsen, Sterling Supply & Manufacturing Company; E. A. Record, Vacuum Oil Company; John Graham and James Fagan, Wyoming Valley & Wilkes Barre Traction Company; F. A. Lex, A. Whitney & Son; A. McLeod, Lobdell Car Company; E. W. Ash, Schuylkill Traction Company; C. A. Bragg, Westinghouse Electric & Manufacturing Company; Alvin Markle and George Thompson, Lehigh Traction Company; W. Mangan, Camden, Gloucester & Woodbury Traction Company; G. G. Browning, Camden Horse Railway Company; C. Y. Flanders, Morris, Tasker & Company; W. N. Sheif and A. M. Gaazlead, Staten Island Electric Railway Company; H. A. Sage and J. H. Riley, Ogdensburg Electric Railway Company; E. S. Hutchin, Wattington Street Railway Company; W. R. McAdoo, Harrison Railway Company; J. R. Watson, Climax Boiler Company; A. C. Shaw, Boston.

The General Electric Company will make, as usual, an excellent exhibit of street railway apparatus at the Montreal convention. The headquarters will be at St. Lawrence Hall and the exhibit will also be made at the hotel. It will consist of the following apparatus: Two G. E.-800 motors mounted on a Peckham truck to be operated in connection with electric brakes by a B A controller. Behind this will be placed a panel switchboard, consisting of one 3,000 and one 1,000 form K generator panels, one station panel fitted with 5,000-ampere form "G-1" wattmeter for measuring total station output, a 5,000-ampere illuminated dial ammeter, one form A and one form B feeder panels, two section switches, one 4,000-ampere receptacle and one 6,000-ampere receptacle with fuses. The company will also exhibit its triad of motors, consisting of the G. E. 800, the G. E. 1,200 and the G. E. 2,000, in connection with the controllers for operating each. In addition a circuit of arc lamps and a general assortment of overhead and other railway supplies will be shown. The exhibit will be illuminated by electric signs and several interesting pictures will be shown. The following representatives will be present:—New York office: W. J. Clark, R. H. Beach, A. K. Baylor, T. Beran, J. McGhie; Schenectady, N. Y: J. R. Lovejoy, W. B. Potter, H. C. Wirt; Boston: F. W. Kimball, P. L. Saltonstall, C. C. Pierce, P. Hodges; Philadelphia, Pa.: H. J. Crowley; Chicago, Ill.: T. P. Bailey, F. N. Boyer; Cincinnati: F. H. Strieby; Atlanta, Ga.: S. W. Trawick; Baltimore: F. C. Todd; Harrison: A. D. Page; Buffalo: T. H. Fearey.

The Taunton Locomotive Works, of Taunton, Mass., will make an exhibit of special interest to practical railway men at the present time. There will be on exhibition three snow-plows, two of the nose or single-track type, and one of the double-track share type. The company will exhibit on the tracks of the Montreal Street Railway Company a street sprinkler, which, through the courtesy of Granville Cunningham, the general manager, will be shown in operation, so that the delegates may see just what it will do. The plows will be noted as unusually heavy and substantial, and especially is this true of the heavy nose plow, which has unusually large and heavy nose pieces and is unusually heavy. The motors are on the axles, and the operating mechanism is at either end of the cab or house, and it is operated entirely under cover. In the nose plow the two noses balance each other, so that when one rises the other falls, and when they both are at an equal distance from the track, they clear the rail by four inches. The digger mechanism is operated by a single quick-acting lever, and each wing is operated independently by a lever of its own. The plows are raised and lowered by a horizontal hand-wheel, using a cast-iron gearing. In the share plows, the two shares are counterbalanced by weights and work independently of each other, while the digger mechanism is substantially the same on both plows. The Standard nose plow is somewhat smaller in size and lighter in weight than the heavy type, but still heavier than the ordinary plow. The company will be represented by Mr. William R. Billings, treasurer, and the selling agents, Messrs. Wendell and MacDuffie, of New York.

Mr. C. E. Carpenter, vice-president of the Carpenter Enamel Rheostat Company, will attend the convention.

Mr. E. W. Little, general manager, will represent the Interior Conduit & Insulation Company, of New York.

Mr. James Trimble, of New York, will attend the convention, and will be able to give some information in reference to car building.

The Barney & Smith Car Company, Dayton, O., will make no exhibit, but will be represented by Mr. Wiliam F. Boss, assistant superintendent.

The composite brake shoe of Boston, whose brake shoes have stood so well the test of actual service, will be represented by Sibley & Co., of New York.

The Philadelphia Electrical Equipment Company will be represented by Mr. Edward T. Watt, who will call attention to the new work now being done by the company.

The New York Insulated Wire Company will be represented by Mr. T. H. Hover and others, and the interests of Grimshaw white core and Raven white core wires and cables are safe in their hands.

The Wason Manufacturing Company, of Springfield, Mass., will be represented by Mr. Louis C. Hyde, who will be able to give interesting information regarding cars, car wheels and railway castings.

The Crane Company, of Chicago, will make an interesting exhibit, which will, in the main, consist of valves, but will include other articles of interest to power users. Mr. G. A Hurd will be the company's representative.

Hoefgen, Moxham & Co., contractors and general supply dealers, New York, will be represented by Mr. Henry K. Kirkham, who is prepared to estimate on complete equipment for electric railways or lighting plants.

The Westinghouse & Electric Company, of Pittsburg, Pa., will be represented as usual by a large delegation from its business and engineering departments. The company will have much to show that is of special interest in the street railway field at the present time.

Mr. Wm. J. Hammer, consulting electrical engineer, New York, will attend the convention. Mr. Hammer, as assignee of Mr. Francis R. Upton, has an assortment of imported and domestic carbons and arc lamps for alternating and direct circuits which he proposes to dispose of at low figures.

The New York Car Wheel Works, Buffalo, N. Y., will exhibit "machined" wheels for electric railways, both loose and fitted up on "special" cold rolled axles. The company will be represented by Mr. T. H. Griffin, president, Mr. T. Guilford Smith, vice-president, and Mr Robt. J. Mercur, general agent.

Charles N. Wood, of Boston, will attend the convention. Mr. Wood makes a specialty of second-hand railway machinery, and will be glad to meet those having generators or motors to dispose of. Mr. Wood will also represent the R. D. Nuttall Company, of Allegheny, Pa., of which he is the New England agent.

The Cambria Iron Company, Philadelphia, Pa., will be represented by Mr. Wm. A. Washburne, New York sales agent, who is prepared to contract for rails in 60-feet lengths. Among recent contracts closed by Mr. Washburne for 60-feet rails are the Buffalo & Niagara Falls Railway and the Staten Island Electric Railway.

The American Electrical Works, of Providence, R. I., will be represented by Mr. Ackerman, of New York, and Mr. Donohoe, of Chicago. The company's wires are now known to street railway men the country over, but the company will probably bring to the attention of delegates several novelties, one of which is the new rail bond soon to be put upon the market.

C. C. Sibley & Co., of New York, will be represented by Mr. T. M. R. Meikleham, and will exhibit the Barnard Selector Signal and Telephone System. They will also represent the Composite Brake Shoe Company, of Boston, the Eastwood Wire Manufacturing Company, of Bellville, N. Y., and the manufacturers of the Tiger brand insulation tapes and rubber goods.

The Graham Equipment Company, of Boston, will make an exhibit of which Mr. J. H. Graham, the general manager, will be in charge. The company will show one of its steel-framed cars, the merits of which are well known. Mr. Graham will be able to give some interesting information concerning the results attending the operation of these cars in regular service.

The India Rubber & Gutta Percha Insulating Company, of New York, will be represented by Mr. F. W. Harrington, who is an able exponent of the merits of Habirshaw "wires, cables and cores." Mr. J. W. Godfrey, manager of sales, is also expected to be on hand and have something to say about "Red, White and Blue." A convention would not be complete without Mr. Godfrey.

The Sterling Supply Manufacturing Company, New York, will be represented at the convention by the following: Messrs. J. H. Carson, J. J. Kennelly, superintendent; Geo. S. Whipp and Geo. Rumrill. This company has arranged for 400 feet of space, where it will have on exhibition fare registers, street-car fenders, sand boxes, brakes, overhead material, and, in fact, everything it manufactures.

The Peckham Motor Truck & Wheel Company, of New York, will be represented by the president, Mr. E. Peckham; Mr. C. E. Crooke, general sales agent; Mr. A. W. Field, manager of the Boston office; Mr. W. H. Wilkinson and Mr. E. G. Long. The company will show two of its extra long trucks of the well-known Peckham type. These will be equipped with life guards, and will form an exhibit of interest to practical railway men.

The Tandem Brake Company, of New York, will be represented by Mr. Edward B. Wyman, the general manager; T. H. Allen, the master mechanic, and Mr. A. W. Drugman, of Toronto, who is secretary of the Tandem Brake Company of Canada. The effectiveness of the company's brake will be very clearly demonstrated at Montreal as cars equipped with tandem brakes will be operated on the lines of the Montreal Street Railway Company.

The Standard Paint Company, of New York, will have "P. & B." well represented by Messrs. H. F. Gillespie and F. De Ronde, from New York, and J. C. Shainwald, manager of the Chicago office, from whom delegates can obtain information concerning "P. & B." products, either verbally or typographically expressed. As these efficacious preventatives have for years been held in high favor by manufacturers, repairers, and users of electrical apparatus, it is by no means for the purpose of introducing "P. & B." to the fraternity that these gentlemen are going to Montreal, but rather to discuss its numerous victories and arrange for more of them.

The New Haven Car Register Company, of New Haven, Conn., will be represented at the convention by Mr. F. C. Boyd, vice-president and general manager; Mr.

John S. Bradley, secretary and treasurer; Mr. Frank A. Morrell, and Mr. A. N. Loper. A full line of the reliable and ornamental fare registers, which are now so favorably known, will be exhibited. A special feature will be an exhibit of the double and triple registers, which are now attracting a great deal of attention, and for which the company has of late taken a number of contracts. The company is at the present time making an exhibit in the Electricity Building at the Atlanta Exposition, which has been favorably spoken of.

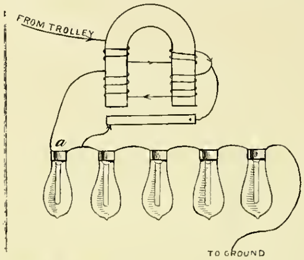
Comments and Views of Contemporaries.

Trolley Mail Service.—The success of this method of mail distribution means ultimately much more than its application to a mere city mail service. The trolley lines which extend to the suburbs of all our chief cities will eventually be utilized for a country service, giving the small outlying towns frequent daily deliveries instead of the deliveries at long intervals now furnished by the steam railway lines. The trolley cars run at short intervals, stop everywhere they are wanted to, and it will not be a matter of insurmountable difficulty or of long delay to put mail cars on all suburban trolley lines that will give the small towns a mail service equal to that enjoyed by the large cities before the advent of the electric railways.—*Philadelphia Times*.

The Question Settled.—A great deal of time is wasted in this world by leaving things to the wrong people. Here are Mr. Lowber Welsh and Mr. Widener and three or four other men who suppose, because they have built and managed street railways, and invested millions in them, that they know all about the business, perplexing themselves over the problem of the proper rate of fare. They compare their observations, study the figures and estimate future results, and still are undecided. Yet while they are thus puzzled, the United Labor League, as a mere incident of a Sunday afternoon meeting, has settled the whole matter in a few minutes and determined that the fare should be three cents. The experts who reached this decision were two printers, a baker, a machinist and a female reporter. They didn't have to bother about receipts and expenses, fixed charges, or any of those trivialities. They just had one of the printers write a resolution in favor of three-cent fares and passed it unanimously, and the thing was done. How wretchedly slow and inefficient are the methods of the capitalists when contrasted with the breezy, off-hand promptness of this Sunday afternoon reform. It did not even occupy the whole session, for the League had already had time to discuss the finances of its official organ—in which, we regret to say, there is a deficit of $20.34—the superior advantages of union-made bread and the traveling expenses of Kier Hardie. Not till these great fiscal problems were disposed of did the United Labor League take up and settle the question of railway fares. The skeptical reader may perceive, in the absence from the meeting of Messrs. Walsh, Widener and others officially connected with the conduct of the railways some ground to doubt the finality of this decision. It is true that the resolution may require their indorsement, but that is evidently a mere formality. Several able editors have already pointed out to these gentlemen how little they know about their business, and as they must be already convinced of this, they will certainly be pleased to have the perplexing question settled for them. Still, passengers will do well to provide themselves with five-cent fares for a while longer, until the traction people have been heard from.—*Philadelphia Times*.

Electric Lighting in Trolley Cars.

The lighting of electric cars by the use of five 110-volt lamps in series has always been very satisfactory when the 550 volts is well maintained between the trolley and the ground. The station engineer, however, is told to maintain a constant pressure at the bus bars, and hence a call for heavy current at any point on the line is sure to be accompanied by a fall of potential in the same locality. The observing electrician and the man of business alike have noticed the result, for dimming of the lamps due to this fall of potential often makes them but little more satisfactory than the oil lamps of horse-car days. In view of mending these matters the following suggestion is offered for what it is worth. In the accompanying figure is represented an electromagnet with two sets of bobbins and five lamps in series, one of which requires a voltage nearly equal to the maximum variation of voltage on the line.



DEVICE FOR CUTTING OUT ONE LAMP.

When the voltage falls and the current weakens, in consequence the armature of the magnet falls, cutting out the lamp and a portion of its own coils as well. Owing to this latter fact it does not pick up when the current rises, and thus cause a continual flicker. The lesser number of turns available on the magnet demand a stronger current than the normal to cause the armature to be raised. It would seem that a little ingenuity and experiment along this line would perfect a useful device, entirely automatic in its action. The proper number of turns for the bobbins could be very readily determined as follows: First determine the ampere-turns required to raise the armature, and then the maximum number of ampere-turns at which it will be released. Then determine the maximum and minimum currents that it is wise to allow. Divide the ampere-turns necessary to raise the magnet by the maximum current, and obtain the number of turns for the upper pair of bobbins. Divide the maximum number of ampere-turns at which the armature is let fall by the minimum current allowed, and the result gives the total number of turns of both bobbins. The turns of the lower bobbins may then be found by subtracting.

Of course it is possible, by choosing too high a minimum current, to obtain a lesser, rather than a greater, number of turns than those on the upper bobbin, for the sum total. This must be provided for by making the mechanism sensitive enough to allow a small difference in exciting power to permit it to act, and also to avoid drawing too fine a line between maximum and minimum currents.

Toronto Street Railway.

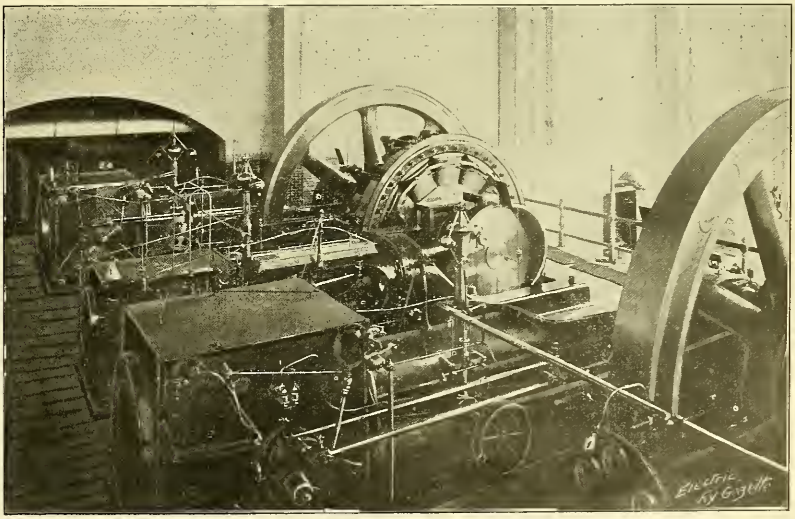
The Toronto Street Railway is the most extensive as well as one of the most interesting electric traction systems in Canada. It has attracted no little attention because of its unusual agreement with the municipality. So far as the city is concerned, an eminent economical writer says of its franchise that "it is the most complete and satisfactory ever granted in America." This contract, which will run 30 years from Sept. 1, 1891, provides that the company shall pay to the municipality at the rate of $800 annually for each mile of single track, and $1,600 for each mile of double track. It further agrees to pay percentages of gross receipts from all sources, as follows: On all gross receipts up to $1,000,000 per annum, 8 per cent.; on receipts from $1,000,000 to $1,500,000, 10 per cent.; from $1,500,000 to $2,000,000, 15 per cent., and on all gross receipts over $3,000,000, 20 per cent.

JAMES GUNN, SUPERINTENDENT OF THE TORONTO RAILWAY COMPANY.

The history of Toronto street railways dates back to 1861. The company organized in that year operated the first railway of the kind in Canada. The first road was constructed in Yonge Street, the main thoroughfare of the city, and the second, in Queen Street, was opened to the public on Dec. 2, 1861. The average number of passengers carried daily on the former road was 1,270, and on the latter 688. The lines were operated by horses until three years ago. The change to electricity was made when the present owners secured the franchise, and was in fact one of the conditions in the contract with the city. The value of the franchise is indicated by noting the prices which have been paid for it. In 1873 Frank Smith, now Sir Frank Smith, purchased the interest of William T. Kiley, who was owner of half the property, for $250,000. The amount paid the owners when the first 30 years' period terminated in 1891 was $1,453,788. The progress that has been made since that time is shown in the annual statement. In 1892 the gross earnings were $820,098.49; in 1893, they had increased to $900,232.59, and for the year ending Dec. 31, 1894, the aggregate was $958,370.74. There are few, if any, better managed street railways in America. As the business was more thoroughly systematized, and as the gross earnings increased, the operating expenses were reduced. For the three years named these expenses have been as follows: 1892, $590,333.26; 1893, $537,597.15; 1894, $517,707.53. The net earnings were as follows: 1892, $229,765.23; 1893, $362,635.44; 1894, $440,663.21. The number of passengers carried in 1892 was 19,122,022; 1893, 21,215,010; 1894, 22,609,338. The transfer system in Toronto is a liberal one for passengers. The number of transfers issued in 1892 was 5,592,708; in 1893, 8,477,147, and in 1894, 7,438,171. The proportion of operating expenses to earnings has been as follows: 1892, 71.9 per cent.; 1893, 59.07 per cent.; 1894, 54 per cent. The net profits for the year ending Dec. 31, 1894, were $250,695.18, as against $212,859.81 for the previous year.

The success which has attended the Toronto Street Railway under electric power during these three or four years has been due, not alone to wise and careful management, but also to the business enterprise that has been shown in creating new traffic. The planning along this line has been done to a large extent by James Gunn, superintendent of the Toronto Street Railway Company, who has been identified with the local system since 1869. Private cars are not infrequently chartered and run over the important sections of the system, and during the Summer trolley excursions have become popular.

The fare tickets of the Toronto Railway Company are sold as follows: The yellow ticket, 25 for $1; the blue ticket, 6 for 25 cents; the red ticket, or workingman's ticket, as it is sometimes called, good only between the hours of 5.30 and 8 a. m., and 5 p. m. and 6.30 p. m., 8 for 25 cents, and children's school tickets, 10 for 25 cents. Night cars are run on all main lines at 12.35 a. m., and every hour after that until 4 o'clock a. m. The fare on night cars is 10 cents. No Sunday street cars are operated. The car equipment includes 166 motor cars and 70 trailers. The company also operates six new parlor cars, which are unusually handsome in their design.

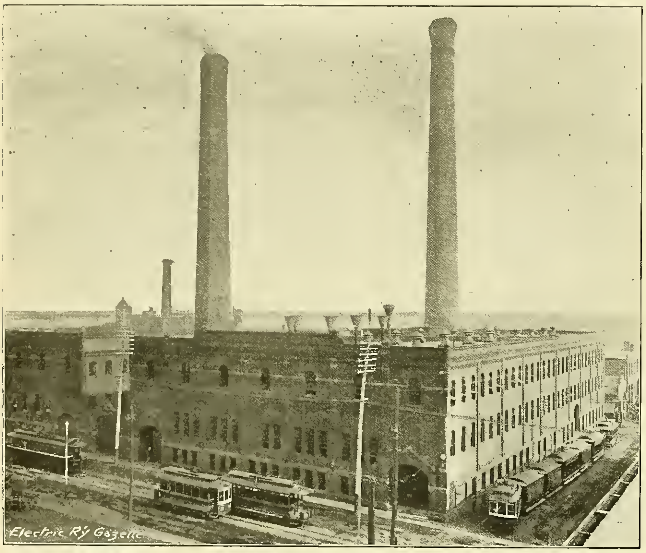


POWER PLANT.

The company operates a trolley street sprinkler, with a capacity of 3,000 gallons of water, on the main streets. An experiment has been made in conveying the city garbage in cars by night, but this plan of disposing of the refuse has not been definitely adopted. The operation of a trolley postal car is considered probable in the near future.

The railway system includes 81½ miles of track, all of which is operated by electricity. The track construction is substantial throughout and iron poles are used. The supervision of the construction, so far as the city is concerned, is assumed by the city engineer.

The power-house of the company, which is conveniently located on Front Street, a block east of the City Hall, is a large and massively built structure. The stack rises to a height of 250 feet, and is said to be the highest in Canada. In its construction excavation was made to a depth of 18 feet, where solid rock was struck. The concrete foundation, 40 feet square, is built on the rock, and was capped up until it stood 24 feet square on the surface of the ground, where the chimney proper was begun. For the first 50 feet the chimney is square; the top, which is 18 feet 3 inches in diameter, is capped with cast-iron. The inside diameter is 12 feet. A ladder, made of U-shaped irons, is provided as a means of ascending, the ends of the irons being anchored in brick.



POWER STATION.

General Electric, Westinghouse and Siemens & Halske electric machinery is installed in the station. One of the engines, built by Laurie Bros., of Montreal, is of 1,600 hp, and drives an 800-kw multipolar generator, built by the Canadian General Electric Company. In June of this year a Bertram 1,600-hp engine was installed to drive a Siemens & Halske 800-kw multipolar generator. The plant also includes five Armington & Sims cross-compound engines of 620 hp each. Steam is generated in 18 boilers, six of the number being of the marine type of 500 hp each. Two nests of Green's economizers, having 1,000 four-inch pipes with headers, are in service. The coal-conveying machinery, furnished by Borden & Sellick, of Chicago, has a capacity of 400 tons in ten hours. The conveyers are operated by three electric motors of 15 hp each.

The mechanical management of the system is under the charge of D. C. McLean, the chief engineer. The officers of the company are: President, Wm. McKenzie; secretary and treasurer, J. C. Grace; comptroller, J. M. Smith; superintendent, James Gunn, and chief engineer, D. C. McLean.

Novel Method of Invalidating a Franchise Sale.

The franchise that has been applied for by the People's Traction Company of New York was offered for sale at auction on Wednesday last, by the city comptroller. The bidders were the People's Traction Company, the Northern New York Traction Company and the Southern Boulevard Company. President Wilcox, of the first named company, filed a protest against the other bidders, claiming that the companies which they represented were not organized in good faith, but simply as a means to aid in perpetrating a monopoly. His protest was overruled and the bidding proceeded, the offers increasing till one of 4 per cent. of the annual gross receipts was made. The Southern Boulevard Company then withdrew. The remaining companies continued their bids till one of 39 per cent. of the gross receipts had been reached. Then the People's Traction Company bid 97 per cent. for the first five years and 95 per cent. thereafter. The Northern New York representative promptly trebled the bid, which was protested as illegal and void, but upon Comptroller Fitch remarking that he would take all the bids offered the figures rapidly rose to even more ridiculous figures. Not until the People's Traction Company had bid 6975 1-16 per cent. was the sale suspended.

New York Rapid Transit.

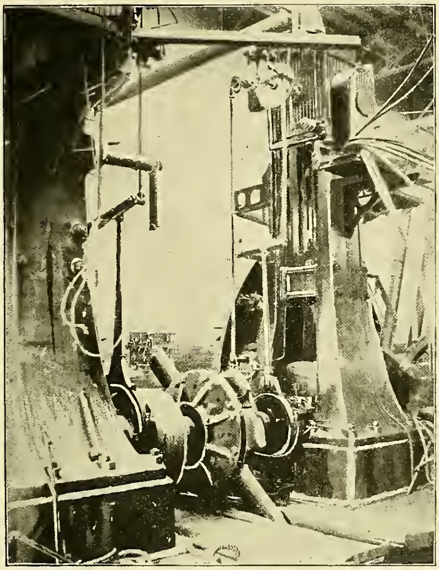
The New York rapid transit commissioners applied to the General Term of the Supreme Court on Oct. 7 for authority to construct subways in the streets, despite the opposition of a few abutting property owners. The motion was denied on the following day, not upon its merits, but because the court held that the application should have been presented to an appellate division consisting of five judges appointed by the governor. This course cannot be followed till Jan. 6 next. In the meantime, the commission has the alternative of carrying the case to the Court of Appeals, and as it is given preference it is possible that a hearing could be had within a week. As the commission is in no hurry it is probable that the matter will be held over till January, the interim being devoted to the perfection of the details of the plans.

Electricity on Steam Lines.

The annual report of the New York, New Haven & Hartford Railway Company states that it is probable that electricity will be adopted at a number of points on the system. It is also mentioned that the current expenses for fuel on the Nantasket Beach electric line indicate that the power is economically obtained.

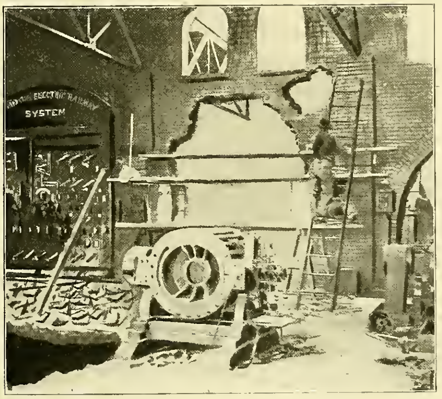
Fly-Wheel Accident at Hoboken, N. J.

A serious accident occurred in the station of the Hudson Electric Light Company at Fourteenth and Bloomfield Streets, Hoboken, N. J. Shortly after three o'clock on the morning of Saturday, Oct. 5, a fly-wheel, 17 feet in diameter, burst, killing the engineer in charge of the plant and injuring two assistants. The plant furnished arc and incandescent light to the city of Hoboken and supplied power for operating several of the lines of the North Hudson County Railway system. The station was fully described in the Gazette of May 4, 1895.



VIEW OF WRECKED ENGINE.

The engine equipment consists of two vertical cross-compound Corliss engines, of 500 hp each, built by the Philadelphia Engineering Works; one cross-compound Corliss engine, of 1,500 hp, of the same make, and one McIntosh & Seymour double cross-compound engine of 650 hp.



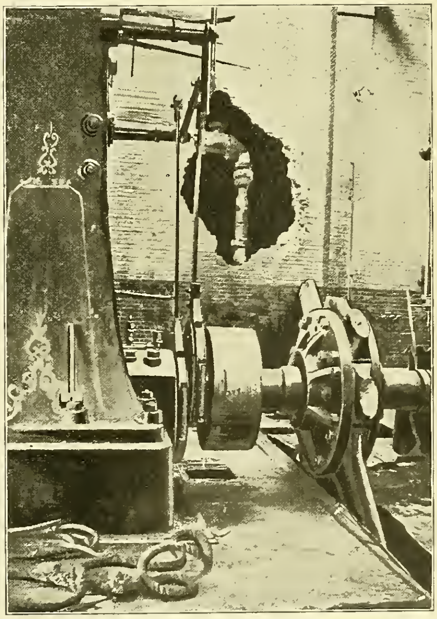
CORNER OF GENERATOR ROOM.

The wrecked engine was one of the vertical compound engines, and was connected to a line of counter-shafting by a 48-inch belt. The belt passed from the fly-wheel under two idlers, and around a pulley on the counter-shaft. From the latter belts extended to the dynamo room on the second story, as shown in the illustration.

At the time of the accident the engine was running four 50 arc-light dynamos, four street railway generators, and one small machine on a stationary motor circuit.

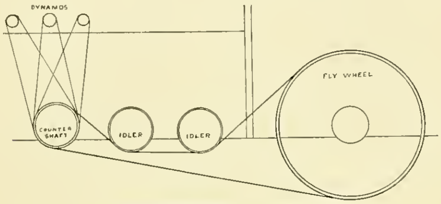
The fly-wheel was 17 feet in diameter, with 52-inch face, and weighed 50,000 pounds. It was made up of eight sections, secured to each other by eight 1¾-inch bolts through flanges. In the middle of each segment was a pad to which the arm was bolted with four 1½-inch bolts. The arms were secured under the hub by three 1½-inch bolts each. The sections separated by breaking the flanges, and no bolts were broken. Three of the arms, which were elliptical in section and solid, were broken short off at the hub, and three were broken at the pad. One entire arm remained on the hub, and one was broken about midway between the hub and the rim, and about one third of the remaining arm was left in place.

The usual safety cams were provided to prevent the steam valves from opening, in case the governor fell too low. When the engine is started the handle is turned to a horizontal position, and the governor is held up by allowing its side rod to rest in a notch. The steam valve is then allowed to open, and as the governor balls rise the handle drops to the vertical position, so that in case of accident to the governor it may fall to its lowest plane, and shut off all steam from the cylinder. The governor was on the front of the platform between the two cylinders, and directly over the fly-wheel, as shown in the engraving. The assistant engineer, Carl Anderson, was in charge of the station on the night of Oct. 4. The conditions which caused the



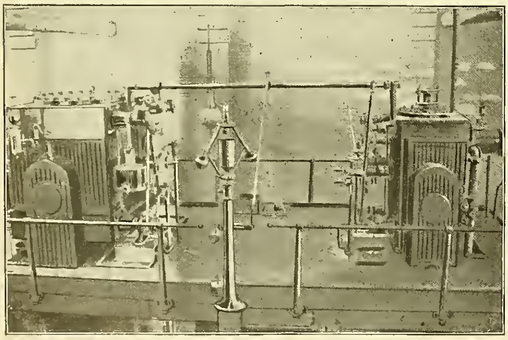
HUB OF FLY-WHEEL AND WALL PIERCED BY SECTION OF RIM.

accident, as nearly as can be learned, were as follows: A short circuit occurred, throwing a heavy load upon the engine, and causing it to slow down. Anderson was on the platform and it is supposed he held the governor up to prevent its falling to its lowest plane, which would bring the safety cams into action, and shut the steam off altogether. The circuit-breakers then dropped and the engine, relieved of its load, began to speed up. The circuit-breakers were thrown in, but immediately dropped again, and the speed continued to increase. As Anderson was still working at the governor, his assistant, who was at the other engine, gave the matter at first no attention, but as the building began to shake the latter sprang to the throttle of the racing engine and began to shut it off, but too late. The two pulleys on the shaft to which the engine was belted went to pieces, and immediately after the big fly-wheel of the engine scattered in all directions, carrying with it the body of the unfortunate engineer, who was directly in the line of projection. Some time seems to have elapsed between the first intimation of trouble and the final crash. One man was injured by jumping from the second-story window, and another slightly bruised by flying timber.



ARRANGEMENT OF BELTS.

The pieces of the wheel left the room in all directions, and a heavy section of the rim tore through the brick wall between the engine and dynamo room, and striking the outside wall at the top of the window, dropped to the bottom of the window. Almost an entire arm lies near the sidewalk on Fourteenth Street and its path through the trees is apparent, indicating that it must have gone through the roof. A part of the rim section, 52 inches wide, four feet long and about three inches thick, and weighing 2,500 pounds, landed on the car rail on the farther side of Fourteenth Street. This also must have gone through the roof. Judging from the angle at which this piece appears to have been thrown, the engine must have been running at about 160 revolutions per minute, its ordinary speed being 100. If the piece had gone 25 feet further south, it would have crashed through a block filled with sleeping tenants. It probably was deflected somewhat out of the plane of the wheel by striking a truss.



CYLINDER OF ENGINE AND GOVERNOR.

Two pieces went through the boiler room wall but caused no more serious damage than deranging the piping. While one went completely through the boiler room, several pieces were found on the northern side, which must have gone through the roof. One of these, weighing a ton, landed in an old canal boat, 330 feet away from the engine room.

Immediately after the accident gangs of men were put at work repairing the damage, and by night the cars were again running.

Electrolysis of Pipes.

In the absence of a complete solution the electrolytic problem tends to become more formidable. The trouble extends to a multiplicity of metallic pipes whose combined value is regarded by the public as much greater than the benefits of a rapid transit service. There are buried in the thoroughfares, water and gas pipes, telephone and telegraph cables, pneumatic tube systems, steam pipes and branch sewers, and they are often interlaced in the most confusing manner. The problem is complicated, too, by the varying conductivity of the earth itself.

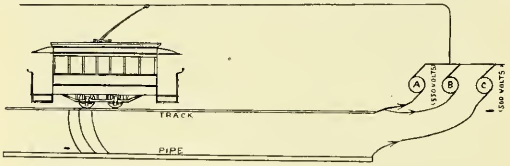


FIG. 1.

It has been customary to search out electrolytic problems with a low reading voltmeter, the terminals of which are applied to different points in the earth, or in the pipe systems. It is well known that a difference of potential of over half a volt will produce electrolytic action, but many writers on this subject have not correctly considered the indications of the voltmeter. The rate of electrolytic action depends not on the voltage, but on the current passing, and it must be leaving the pipe, *i. e.*, the pipe must be positive to the surrounding conductors in order that it may be consumed at all.

Hence a great deal of discrimination must be used in acting on a voltmeter indication in such work. A reading of a difference of potential of one half a volt in dry, sandy soil does not present one tenth the significance that a similar indication denotes when the ground is moist and of low resistance, or if the deflection took place between the ends of a length of pipe.

$E = C R$, and in order to find C large R must be small.

In order to intelligently apply a remedy for electrolysis the case must be specially considered and the cause of the current leaving a pipe at such and such a point and in such great quantity must be determined. Not only that, but it must be discovered where the current goes when it leaves the pipe, or in other words, what path of lower resistance has become available. This may be a pipe that requires protection.

Mr. Harold P. Brown has invented and patented an excellent remedy, so far as it goes, for electrolysis. It is represented in Fig. 1. *A* and *B* represent station dynamos properly connected to the track and the feeder system;

C is a third dynamo which is run at a slightly higher voltage than *A* or *B*, and is attached to the pipes, thus causing the current to take the pipes in preference, and leaving the pipes at the points attached to this higher voltage dynamo. These points of attachment are distributed about the system, wherever the electrolysis is found to be the most pronounced.

This method, however, only partially accomplishes the desired results. It is true that the current tends to stay in the pipe to a much greater extent than before, but it flows through it in a very much greater quantity. If the pipe be connected, as gas and water mains invariably are, by a lead-caulked joint, electrolytic action is set up at every joint, and slowly, but none the less surely, will effect destruction. This damage will proceed more rapidly as time goes by, for as the joint becomes poorer electrically the current takes a path through to the surrounding earth in a correspondingly greater proportion, and wherever it leaves the pipe, even for so short a distance as in skipping a bad joint, electrolysis is sure to occur. Moreover, it is a fact that the pipes of many gas companies are simply holes in the ground lined with oxide of iron, and if current in returning along a gas pipe comes to such a line of piping, it is very liable to find an easier way to get home via some other pipe or rail.

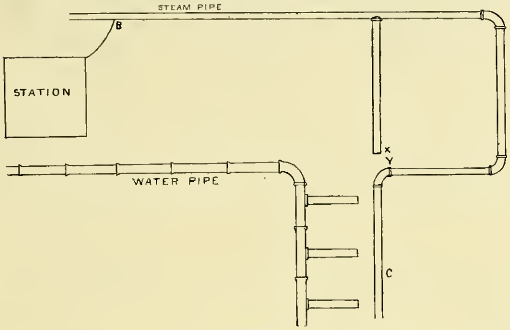


FIG. 2.

The problem resolves itself into determining the flow of current through a most complicated surface. The points where the current enters are many and variable. The resistance of the return circuit varies from day to day. A mere change in the time-table of a road may cause severe electrolysis where none existed before by reason of its bunching the cars at a square or crossing.

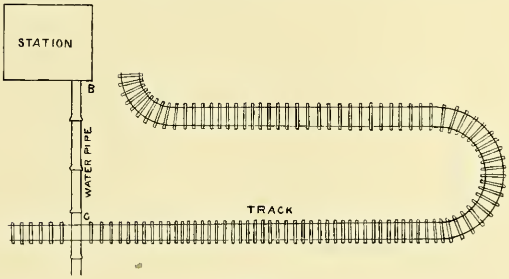


FIG. 3.

There are several things that must be especially looked out for in treating electrolysis.

1st. An electric current must be kept out of a jointed pipe at any cost, for even if it be efficiently protected at the points of leaving it is sure to electrolyze at the joints and produce worse destruction than at a single local effect, although it will take a longer time to appear.

2d. A continuous run of pipe may carry current in considerable quantity, provided it is not allowed to leave it at any but a suitably prepared electrical joint.

3d. Currents are always sure to choose the path of least resistance for flowing in the greatest quantity, and they may abandon one of large area and great conductivity in order to take advantage of a very easy path; easy because of its short length, even though its area be quite insignificant in comparison. This is a point that is very often overlooked.

4th. So long as the pipe affected is continuous, and current gets into it, it is only necessary to look out for the points where it *leaves;* where it enters is immaterial.

5th. Every case requires a special diagnosis, and a special cure.

In discussing this subject further it will prove more instructive to consider a few examples. Fig. 2 shows a line of piping which, it will be assumed, is carrying a large current. As the line of pipe is continuous, it is well enough to let it remain there, but it must not be allowed to leave at any point except *B*, when it is positively connected as to the dynamo. Let us suppose that the pipe receives the greater part of its current at *C*. Then in the case shown electrolysis will take place. In the first place current will take a short cut to the station by way of the water pipe, and opposite every one of the branch lines in the water pipe a hole will be eaten in the steam pipe.

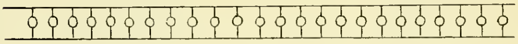


FIG. 4.

This may be prevented by leading home in as nearly a straight line as possible a wire attached to the steam pipe at these points, as set forth in Mr. Brown's method. Second, the current will follow in considerable quantity the path *X Y*, and will electrolyze at *Y*. This may be prevented by connecting *X* and *Y* with a stout copper wire. So much for continuous runs of pipe.

In the case of jointed pipes the currents must be kept out altogether, and the question arises, how shall this be done?

Fig. 3 shows a sample case. The size of wire laid along the length of the track to protect the water pipe, *B C*, would be simply enormous. Although resistance may be reduced by squaring the diameter of the wire, it may be much more cheaply reduced by cutting down the length. In the first case more copper will be added to gain an object, which is just as easily attained by using less copper, and therefore much more economically. Hence, to keep the current out of jointed pipes, or, indeed, any pipes, attach firmly to the rails above several points where the damage takes place, form the wires into one lead, and proceed with that lead, as nearly as possible as the crow flies, to the station. Persons who would seriously object to a trolley system would be particular, indeed, if they fought against a buried ground return. It need only be buried a few feet deep. It is well enough to bond the rails, but when it comes to laying return feed wires, the proper place for them is not between the tracks. No one thinks of laying out a system of incandescent lamps as in Fig. 4, and why should this practice be so persistently followed in railway work?

How to Throw On a Railway Generator.

Many subordinates in power stations who are striving to climb higher do not know how to properly throw a railway generator on to the line, or to throw it off when the run is ended. Railway generators are usually arranged for connection to the switchboard in one of three ways. Some are provided with a double-pole switch, and the equalizers are permanently connected together. Some have a triple-pole switch and an equalizer bar, while others have three separate switches. These three methods of connection are shown in Figs. 1, 2 and 3, and in each case it is necessary to follow a slightly different method in throwing the machine on the line.

In any case the following precautions should be carefully observed:

A generator must not be thrown on a set of bus bars to which several dynamos are supplying current unless the voltage of that generator is equal to that of the bus bars. A large generator when thrown into multiple with a small generator will operate the latter as a motor unless the larger generator has a slightly lower voltage. If several small generators are connected on the line and their combined capacity is greater than that of the large one, this precaution need not be observed. It should be remembered that when there are two machines the bus-bar voltage is always that of the generator of the greater capacity. Therefore this should not be high enough to overpower the smaller machine. It is wise to have the voltage slightly lower at the time the machine is thrown in.

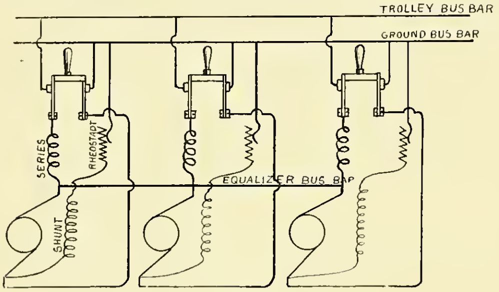


FIG. 1.

The method of procedure in case of Fig. 1 is as follows: With the brushes raised start the generator, being sure that the oiling devices are working properly. When full speed has been attained, see that all switches are open and then let down the brushes, being careful to adjust them so that they run without cutting or "squealing." Then step to the switchboard. Throw in the equalizer switch if there is one, and give the rheostat a turn, and let the machine build up. While the machine is building up consult the ammeter, which gives the total load on the station, and then make some such calculation as this: "I have at present a total load of 800 amperes. When this new machine is thrown in the combined capacity of all the machines running will be 1,200 amperes. Therefore, eight twelfths of the capacity of the machine is the load it should carry."

The capacity of the machine is 250 amperes; $\frac{8}{12}$ of 250 is 167 amperes approximately. This, then, is the load which the generator should carry. Probably before this calculation is finished the machine is ready to be thrown in. Bearing in mind the precautions already mentioned, bring the voltage of the machine up to the proper amount. Proceed slowly. It takes time for a machine to regulate. After the desired voltage has been reached, and shows no tendency to change, throw in the double-pole switch. Attention should at once be directed to the ammeter. By means of the rheostat adjust the current to 167 amperes in accordance with the previous calculation. It will be found that the instrument will now readily respond to the motions of the rheostat, while the voltage depends on the voltage of all the machines and, therefore, has passed out of control.

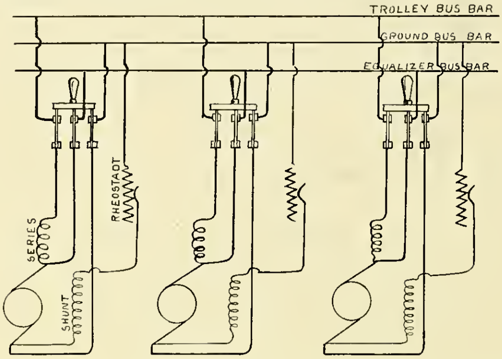


FIG. 2.

With the three-throw switch the procedure is exactly the same, only the equalizer is thrown simultaneously with the other terminals.

With the three separate switches the controller is a little more convenient. The equalizer should be thrown first and then the switch on the positive side. All coils and instruments are by common custom placed on the outgoing wire, hence the series coils are thrown in multiple with the series coils of the other machines, and are receiving a current which provides an initial excitation for the field magnet. This prevents annoying refusals of the machine to build. After the machine has acquired the proper voltage, throw the positive switch, observing the same precautions as in the other cases.

To shut down a machine at the end of a run, stand with one hand on the main switch, and give the rheostat a slight turn, which will tend to weaken the field. The load will gradually come off the machine as will be shown by the ammeter. Watch this instrument, and when the reading denotes about one fourth load, throw the main switch at once. This permits the load to be gradually thrown off, and the danger of racing and wrenches to both dynamo and engine are avoided.

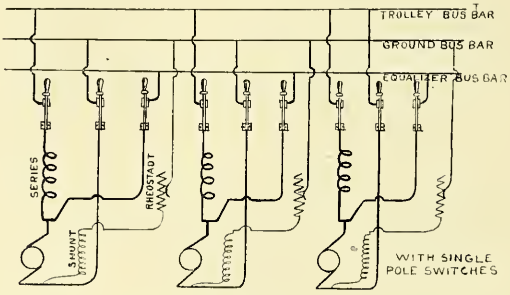
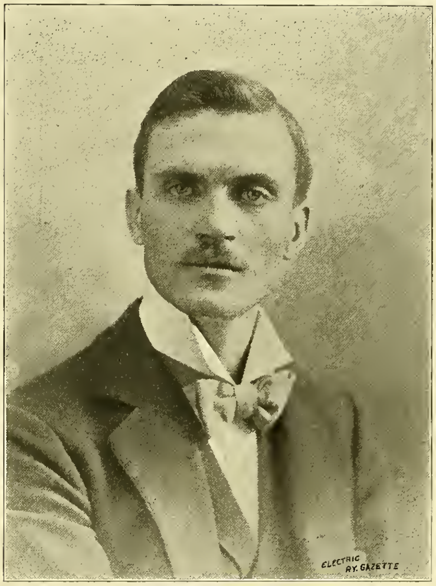


FIG. 3.

Street Railway Engineers—XXIII.

CHARLES E. A. CARR.

Mr. Charles E. A. Carr, of the London Street Railway Company, of London, Ont., is said to be the youngest manager of an electric railway in America. Besides his work at the manager's desk Mr. Carr's duties include those of treasurer of the company as well as electrical engineer. He was born in 1870, near Barrie, in Simcoe County, Ont., and he attended the schools of that town. He completed his education in Toronto, and engaged for a short time in commercial work, but his inclinations led him to accept a position in the office of the city engineer of Toronto, and he gained, while employed in this department, a practical knowledge of civil engineering. While in this office he was brought into familiar association with street railway matters. He was one of the party of City Hall attaches who made the famous midnight demand for the surrender of the local railway to the Municipality. When the railway system was turned over by the city to the present street railway company Mr. Carr was assigned to the task of checking up the property included in the transfer. In January, 1893, he accepted the position of private secretary of Mr. Henry A. Everett, then manager of the Toronto Street Railway Company, which had decided to equip its system for electric traction. During his connection with the company Mr. Carr gained a practical knowledge of electric railway installation and operation which has since stood him in good stead. He was appointed manager of the London Street Railway Company early in the present year, and he has since that time been engaged in substituting electricity for animal power on the lines. Under his supervision an excellent system has been introduced which will afford as satisfactory a transportation service as can be found in any of the Canadian cities.



CHARLES E A. CARR.

Electric Traction on the Brooklyn Bridge.

So much inconvenience has been experienced in switching trains in the New York & Brooklyn Bridge terminals, and the time now lost in coupling and uncoupling engines is so valuable during the busy hours, that the trustees are seriously considering the adoption of electric motors to replace the steam service. Six locomotives are now employed to switch the trains as they leave the cable of the bridge railway over to the outgoing tracks, giving them sufficient start to reach and clutch the cable. For the proposed electric switching service the Westinghouse electromagnetic railway system is under consideration. According to the plan a motor on the truck of the first car will carry the train to the terminus after the cable is dropped. A motor on the rear car, which becomes the front car on the return trip, would then switch the train to the outgoing tracks until the cable was picked up. If successful the electrical system will eventually supersede the cable. A decision in the matter will probably be reached by the trustees this month.

Alleged Infringements of Electric Conduit Railway Patents.

Elias E. Ries, of Baltimore, and Albert H. Henderson, of Philadelphia, have brought suits against the Metropolitan Traction Company, of New York, and the Metropolitan Railway Company, of Washington, for alleged infringements of patents relating to underground conduits for electric railways. The complainants allege that the Lenox Avenue conduit line constructed by the Metropolitan Traction Company, in New York, and the conduit system installed by the Metropolitan Railway Company, in Washington, embody infringements of patents granted to Mr. Ries and owned by the complainant. The patents which it is alleged are infringed are seven in number, and were granted in 1886, 1887, 1888 and 1889. They relate to underground conduit railways and an electric railway crossing.

A Baltimore Electric Locomotive.

One of the electric locomotives used in hauling freight trains through the Baltimore belt line tunnel demonstrated this week that its drawing power exceeds the expectations of its builders, the General Electric Company. Forty-four loaded freight cars, and the three steam locomotives not working, which had been used to haul the heavy train on the surface, were coupled to the electric locomotive at the tunnel entrance and were pulled up the heavy grade at a speed of 12 miles an hour. The total weight of the train was 1,900 tons. The drawbar pull exerted in starting this unusually heavy load was more than 60,000 pounds, and continued throughout the trip at more than 40,000 pounds. Baltimore & Ohio officials claim that no steam locomotive, however, approached this record.

Probable Lease of a Brooklyn Company.

Negotiations for the leasing of the Brooklyn Traction Company by the Nassau Electric Railway Company have been in progress for some little time. The former company controls the Atlantic Avenue and the Brooklyn, Bath Beach & West End railway companies. Up to the present time no agreement has been reached, but it is not doubted that an understanding will ultimately be arrived at. It is conceded that a union of the two interests would be mutually advantageous and profitable. It would give valuable connections to each company and it would enable the Nassau cars to reach the Brooklyn Bridge terminal and Fulton and South ferries.

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THE MONTREAL CONVENTION.

Unless all signs fail the convention of the American Street Railway Association in Montreal, next week, will be an unusually interesting and profitable meeting. The programme, which we print elsewhere in this issue, indicates that proper provision has been made for both the business and social features of the gathering. It will be seen that the hospitable residents of Montreal have not been satisfied with arranging for the entertainment of their guests for four days, as provided by the original programme. They have added a fifth day, and have formed plans which are certainly attractive enough to induce many of the visitors to prolong their stay. That the attendance will be large there can be no doubt, and we have received from manufacturers assurances which indicate that the exhibit of street railway apparatus and supplies will be in every respect creditable. Montreal has earned a deservedly high reputation as a convention city, and nothing that can be done to promote the pleasure or the profit of the delegates and visitors will be left undone next week. Those who have left open until the last moment the question of visiting Montreal, we would earnestly urge to attend the convention. To street railway men and manufacturers alike it offers opportunities that should not be neglected.

FLY-WHEEL ACCIDENTS.

The recent fatal fly-wheel accident at Hoboken, N. J., presents another forcible argument against the use of cast-iron for fly-wheel purposes. The employment of cast-iron has been condemned for driving shafts by good engineering practice, but the material is still more unsuitable for a fly-wheel. It is then subjected to two stresses, tension and transverse strain, and under such circumstances cast-iron has been found weak and treacherous. Engineers may argue the value of safety stops, but the accident at Hoboken illustrates the fact that they do not afford adequate protection. It appears in this instance that the engineer was assisting the governor to bear up under the load. Suddenly the circuit-breaker dropped, the engine immediately raced and the accident followed. In many similar cases safety stops would prove of no avail. An element of safety should be provided in the construction of a fly-wheel that is simply out of the question when cast-iron is used. Thickening the rim increases the stress per square inch as well as the area in the same ratio, and no gain consequently is made by such an expedient. Stronger material and not a new design is necessary. Fly-wheels built up of wrought-iron plates are now being installed in one of the largest railway power stations in the country, as the management has been convinced, by the results attending their use in a somewhat smaller plant, where they have been employed for two years, that their operation will make accidents like that at Hoboken extremely unlikely. It is not improbable that such a substitution will solve the problem. Let a demand for a wrought-iron fly-wheel be created and a cheap supply will not be wanting. A solid wrought-iron disc with endless rings riveted to its periphery would be an almost ideal construction, and plenty of manufacturers stand ready to make it if they can sell their product.

ALTERNATING-CURRENT TRANSMISSION SYSTEMS.

The two three-phase power transmission systems, which are described elsewhere in this issue, are well deserving of special attention. While it may be said that the installations do not properly mark advances in electric railway work in its restricted sense, they are none the less engineering feats of considerable significance in the field of traction. In both cases the transmitted power is transformed into current suitable for electric railway purposes, and they will doubtless serve as models for installations in many parts of the country where power is to be transmitted over considerable distances. In no place ought systems of this description be of greater interest than in Canada, whose electrical needs have of late become particularly prominent, because of the meeting of the American Street Railway Association in Montreal next week. There are innumerable water powers in the Dominion which, at the present time, are running to waste or at least are only partially utilized. By the application of some such system as that introduced in Portland, power in many instances could be transmitted economically to points where it is needed, and can be used to advantage. Such installations could make available, at no great cost, power for the operation of railways in the number of places in Quebec and Ontario which are at present without adequate means of transit. The utilization of alternating current for power transmission ought to do much for Canadian development, which the statesmen across the line are always planning to promote.

PREVENTION OF ELECTROLYSIS.

New suggestions for preventing the electrolysis of buried pipes by escaping electric railway currents are constantly coming to light, and it is fortunate that so great an interest is taken in the problem. The trouble is an unmitigated evil; its existence means waste of power and destruction of property. When it can be overcome one of the most troublesome conditions in electric railway operations will be eliminated. Two methods of dealing with the problem are described in articles in this issue. Mr. Forée Bain suggests a plan for reinforcing the return circuit, which has proved, he asserts, an efficacious remedy for the trouble. The expense of this method would certainly not be slight, but if it should be as effective as Mr. Bain claims, the cost would be a matter of slight importance. The writer of the second article takes issue with Mr. Bain. He does not believe in following all the twists and turns of a car route when additional copper is used for providing a path of low resistance for the return circuit. He points out that such a course may be ineffective, for the reason that owing to its length the arranged path may have a resistance greater than that of a line of pipes leading perhaps almost directly to the power station. He makes the suggestion, therefore, that the copper returns be led back to the station by the shortest possible route, and in the adoption of this scheme he sees a very considerable diminution of the electrolytic evil. The plan is so simple and seems to promise so well that it would seem well worthy of a trial. It is surprising, in fact, that the suggestion has not been made and acted upon before.

Philadelphia Consolidated Company.

The lease of the Philadelphia Traction Company to the Union Traction Company, the new consolidated company, was formally approved and became operative at once. The three great companies of the city, the Philadelphia, People's and Electric Traction companies are now under the control of a single company. The Union Traction Company has appointed as general manager John R. Beetem, who has been general manager of the People's Traction Company for nearly three months. President Welsh has been empowered to appoint an executive committee of the board of directors, who will take up the matter of the reorganization of the three systems into a single homogeneous system. This committee will consider changes of routes, the transfer system and other proposed changes. It is understood that changes, when finally decided on, are to be made gradually, and that the old management of the three companies will probably remain practically in control for a few weeks.

Brooklyn Loop Terminals.

A compromise has been reached by the Brooklyn Bridge trustees and the Brooklyn Heights Railway Company by terms of which a portion of the plan suggested by the latter for terminal facilities at the bridge has been adopted. The scheme provides for a loop and three extra tracks on the Liberty Street side of the bridge between High and Sands Streets. The down-town cars will turn from Fulton Street to a loop running parallel with the north side of High Street and along the bridge station to Sands Street to the present ferry tracks. Another loop will be formed by a track running diagonally from the point situated on the main Fulton Street track below the bridge station to the rear of the new bridge terminal station. In the morning the down-town cars will follow the first loop and in the evening the second. Only 40 feet of the bridge plaza will be allowed the company instead of the 60 feet asked for.

Prizes for Motormen and Conductors.

The board of directors of the Brooklyn Heights Railway Company has decided to award prizes as inducements to their employees to use all possible precautions to avoid accidents. If the accident list can be appreciably decreased by the plan the money will be well spent. The directors have set aside for this purpose the handsome sum of $10,000. All motormen and conductors now in the service who operate their cars from the present time until May 1 without accidents, causing injury to persons or damage to property, and who have not been suspended for violations of the rules, will receive a pro rata share in the amount.

A Successful and Simple Method for Preventing Electrolytic Decomposition by Railway Circuits.

BY FOREE BAIN.

A great deal has recently been said in regard to the deleterious effects of railway circuits in their action on water pipes, etc., and several more or less complicated remedies have been suggested, some of such embracing special dynamos, connected in various novel if not effective ways to special and additional circuits.

All of such might meet with careful consideration if the evil could not be entirely cured and prevented by the simplest and most rational method, which is free for use without royalty, and which may be used by any one afflicted with the trouble aforesaid.

The remedy, in a nut-shell, consists in having underground conductors equal or greater in current-carrying capacity than that of the overhead conductors, not considering the rails as a part of the circuit. The integrity of the underground circuit must be as carefully preserved as that of the overhead conductors. A failure in this may not lead to immediate disaster, as with the overhead conductors, but it will result in disaster postponed.

Local disintegration of uninsulated conductors laid in the ground is continually going on. The damp earth forms the electrolyte through which parasitic currents will flow between the copper conductors and other metallic bodies adjacent thereto, which are either electro-positive or electro-negative to the copper. This action is galvanic, and continues quite independent of the dynamo current flowing in the conductors, and constantly tends to change the carrying capacity of the underground conductors; added to this is the oxidizing of the contacts and the corroding action of other joints and contacts, all tending to increase the resistance of the circuit. Therefore, it may be seen that the carrying capacity of the underground leg of the circuit is constantly becoming smaller, so that it becomes necessary to start with it abundantly large and to protect it against these effects as intelligently and as persistently as we maintain the insulation of the overhead conductors.

Local galvanic action, such as I here describe, is not that which damages the water pipes or which makes enemies of our telephone friends, for it is only a small thief, the servant of time and the anti-fat of our underground circuits, reducing the carrying capacity of our meagre, niggardly provided underground conductors to such a degree that the current must stray away to water pipes, gas pipes, telephone lines and other conductors which happen to be approximately in the path, and at many and divers points, leaves such to again return to the rails or to other systems of pipes. In its ramifications it performs work by electrolytic decomposition at every point in the circuit where a marked difference of potential exists, and where the current passes through an electrolyte, such as damp earth.

Now, supposing an ideal construction in which the rails were electrically continuous, and of amply large carrying capacity and low resistance so there would be but a slight difference of potential between the extreme ends where the current enters and where it leaves them; when the maximum current is flowing the path of the lowest resistance being through the rails themselves, then there would be no appreciable electrolytic decomposition of the water and gas pipes in the neighborhood of such a road, for the reason that the legitimate circuit provides a much lower resistance than the extraneous conductors.

The rails as electric conductors can not, however, be depended upon in practice, and should not be considered as a part of the circuit for an electric railway system. There should be a sufficiently ample conductor in the return circuit, in addition to the rails, such conductor at least equaling the joint capacity of the trolley wires, the mains and feeders of the overhead leg of the circuit, in order to secure desirable results and maximum economy.

I have equipped in this manner several notable, important and successful roads, which have been in successful operation for about five years, and which have been entirely free from causing electrolytic decomposition of water and gas pipes, and any objectionable telephone disturbances.

The rails were bonded in the usual manner, and a No. 0 copper wire was laid between the rails and connected by cross wires to each bond wire. A large stranded, uninsulated copper wire, in some instances as large as 1,000,000 circular mils, was laid just outside of one of the rails in a trench and connected to the central No. 0 copper conductor at intervals of every 100 feet or more, according to the traffic on that portion of the road.

This large stranded conductor was thoroughly insulated in the following manner: A continuous trough made of two-inch pine lumber, previously boiled in fernolene, was constructed; this was made about one half inch larger all around than the conductor or conductors it was to contain; the trough was laid in a trench outside of and parallel with the rails and deep enough to be below the street paving; the conductor was laid in the box and the taps leading out were attached at desirable intervals. The conductor was supported from the bottom on small cross sticks of prepared wood at intervals of five or six inches; the box or trough was then filled up with hot pitch, the top nailed on and the trough covered over. The taps connected to the central conductor were thoroughly insulated. It is more convenient to lay the underground circuit whipstock fashion than to follow the feeder plan.

The ground terminal of the power plant was connected to this conductor and not to the rails, as usual. In one instance I noticed that the telephone service was greatly disturbed at one time when I connected the ground terminal at the power-house to the water pipes for the purpose of testing the efficacy of the arrangement, and I also noticed that the disturbance appeared at once as soon as the water pipe connection was removed.

The value of a plan, such as I have outlined, is determined by its successful and continuous operation for a reasonable period of time, and I can therefore safely say that the suggestions which I have offered have had a sufficient test in practical operation to render the plan valuable and reliable.

The auxiliary track conductor may be placed on poles if desirable. In this case it may, or may not be covered with insulation; being approximately at the same potential as the earth, there is no danger, and the leakage will be negligible, and being removed from the ground the galvanic action is also nil.

Honors for J. H. Cunningham.

Col. John H. Cunningham, one of the vice-presidents of the American Street Railway Association, has been nominated for State Senator, in Chelsea, Mass.

Three-Phase Railway System at Lowell, Mass.

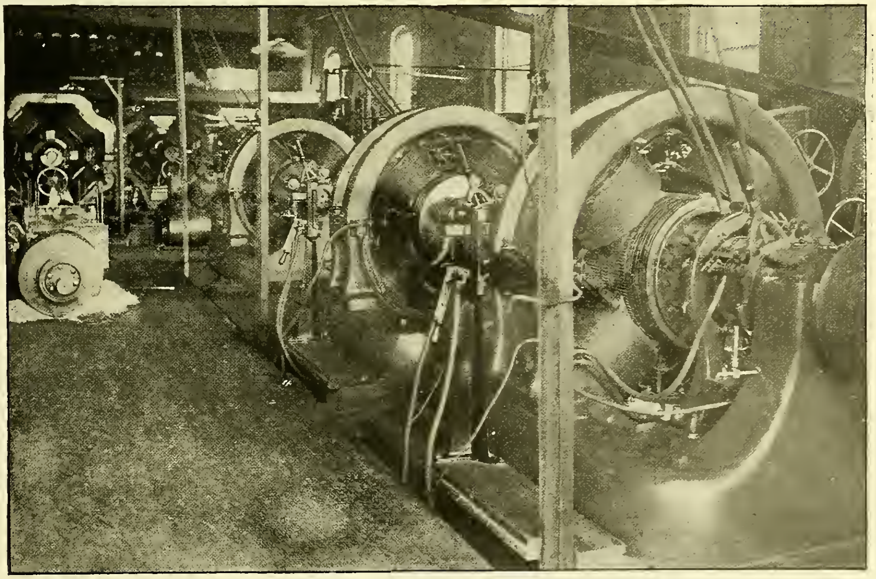
The adaptation of the three-phase system to the operation of the electrical railway is due to the inventive skill of the engineers of the General Electric Company. The first attempt in this direction was made on the Norwich (Conn.) road. In this installation three-phase current generated at Baltic is brought over a distance of four and one half miles, to Taftville, where, in the basement of the Ponemah Mills, it drives a synchronous motor, which, in turn, not only operates all the machinery in that extensive plant, but through counter-shafting, drives several direct-current generators furnishing current for the operation of the Norwich Street Railway, as well as for that of a 40-ton electrical locomotive used as a switching engine in and around the Taftville Mills. The next plant of the kind is to be found at Sacramento, Cal., where current is brought at 11,000 volts from the water-driven generator station at Folsom, 24 miles away. This is transformed at a sub-station and led to motors belted to the direct-current generators which supply the ordinary 500-volt current to the motors on the Sacramento street cars. This plant is now in daily operation and no difficulty has been encountered since the start.

BANK OF REDUCING TRANSFORMERS

In both these instances it will be seen that the three-phase current is used to drive motors, which in turn drive direct-current railway dynamos of the accustomed pattern. At Lowell, Mass., however, the General Electric Company has recently adopted an entirely different method, which dispenses with the second step, *i. e.*, the employment of the motor-driven, direct-current generator. The place is taken by a machine which is in reality a motor and a generator in one.

The company which uses the three-phase system directly in its railway service is the Lowell & Suburban Railway. The problem before the company was how best to connect its terminus at Lakeview, a delightful resort on the lake, owned by the company, with the car line leading to Nashua, fully 15 miles distant. The solution was found in the use of the three-phase system, but not before careful examination had been made of its merits, from the points of view of economy, efficiency and durability, and unprejudiced comparison with other systems.

Briefly, the principle of the installation is this: the three-phase current generated at Lowell is at a pressure of 5,500 volts transmitted, part to a point about midway between Nashua and Lowell, and part to a sub-station at Nashua itself. It undergoes at both these points, first a reduction of pressure in static transformers, and then a conversion from the three-phase current in a rotary converter, emerging upon the feeder and trolley lines a direct current of 500 volts.


THREE-PHASE GENERATING PLANT.

The three-phase generating plant is located in the power-house of the Lowell & Suburban system, situated on Middlesex Street. It consists of three four-pole, 12-okw, 900 revolutions, three-phase generators, each of which is constructed to deliver alternating current at one side and direct current at the other. The direct current is called into action only after the main power plant, consisting of six General Electric M. P. 200-kw belt-driven railway generators, is shut down. The three-phase generators are compact machines, and are connected by belts to a jack shaft which runs the entire length of the engine room close to the west wall. This shafting has been arranged to permit, by means of clutches, any combination of engines and generators. The generators are rated at 216 amperes. The three-phase current issues at a pressure of 360 volts, and is carried to the switchboard—from which it passes to a bank of transformers, erected on a platform, placed in the cellar of the station and set between two of the engine foundations. These transformers are of the General Electric air-blast type. They are cooled by a blast of air driven through them by a rotary blower belted to a 1-hp motor.

ONE OF THE SUB-STATIONS.

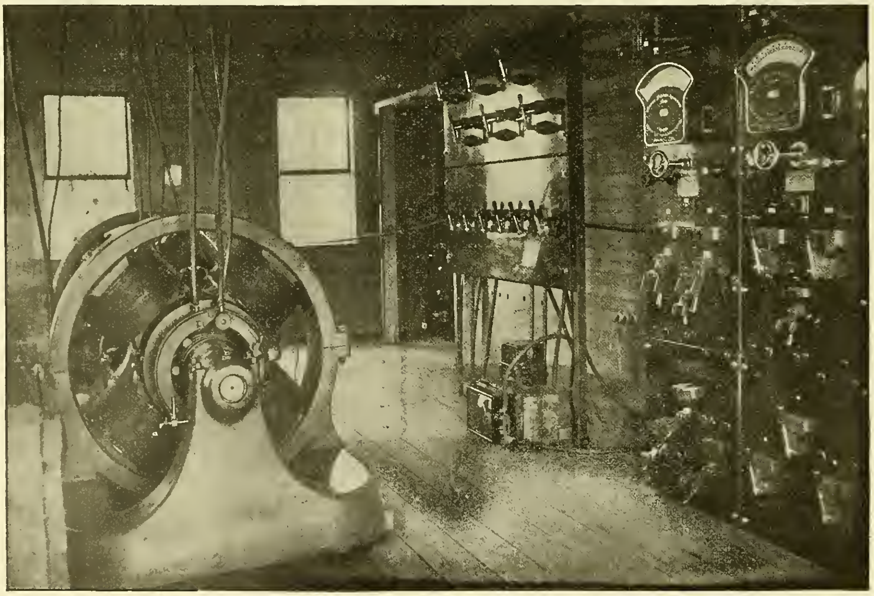
From the transformers the three-phase current issues at a pressure of 5,500 volts, and is carried over insulated cables to a short distance outside the city limits, where it passes to the ordinary three-phase wires which run along the highway upon the same poles that carry the direct-current feeders. The three-phase wires are carried upon heavy wide petticoated glass insulators, set upon the side of the cross arm nearer the road; while the direct-current feeder cables occupy that part of the cross arm on the other side of the pole.

About six miles from Lowell, and a mile and a half from Lakeview, at a place called Eayr's Mills, upon the banks of the Merrimac River, the first sub-station has been erected. This is a wooden structure divided by a partition into two rooms, the outer or that nearer the line being occupied by the rotary converters and direct-current switchboards; the inner containing the bank of reducing transformers, which are cooled by air blast, and the three-phase switchboard.

The three-phase current is brought into this building, from the pole standing nearest the station, over cables to the transformers just mentioned, and the pressure is reduced from 5,500 volts down to the original pressure of 360 volts. The current then passes into the outer room to the two rotary converters; it issues therefrom, railway direct-current of 500 volts pressure, and is carried to the direct-current feeders and trolley wires.

These rotary converters are similar in appearance to the three-phase generators, having at one side collector rings, at which the three-phase current is received, while at the other is a regular commutator from which the direct current is taken.

From the two converters the 500-volt current is carried to the feeders and is fed into the trolley wires, toward Lakeview and Lowell in one direction and toward Nashua in the other, through a regular railway switchboard of panel construction.



ROTARY CONVERTERS.

The sub-station at Nashua is identical with that at Eayr's Mills. It contains two rotary converters, feeding part of the current into the main railway line from the Nashua end, and part into the city lines.

The operation of the rotary converters has proved entirely satisfactory. The machines have been subjected to heavy overloads, sometimes running as high as 50 per cent. more than the rated capacity without any detriment. They run smoothly, and no trouble whatever has been experienced since they were first started.

The cars running between Lakeview and Nashua are of special make, and hold a place about midway between the steam railway car and the familiar street car. They are fitted with 16 benches, and are mounted upon two independent trucks. They are equipped each with two G. E.-800 motors, controlled by "K2" controllers. The speed attained on the open highway between Lake View and Nashua reaches as high as 30 miles an hour without difficulty. The traffic between the two last mentioned points is already very large.

Falk Cast-Welded Rail Joints.

The joint is by far the most troublesome feature of track construction, and many efforts have been made to overcome the difficulties due to this cause. One of the most interesting solutions is that which the Falk Manufacturing Company, of Milwaukee, has been introducing. This company makes a cast-welded joint, and the process which it follows is illustrated herewith. The system, although somewhat novel in the Eastern States, has been adopted with great success in a number of Western cities. In St. Louis the cast-welded joints have stood the test of great extremes in temperatures ranging from over 100 to 20 degrees below zero. The result has been so satisfactory that this system of joints will be applied to the entire 13 miles of track on Easton Avenue as well as on other lines in the city. It is claimed that the union between the rails is so nearly perfect that it is difficult to detect the joints. It is worthy of note in this connection that several miles of the St. Louis track are laid on country roads, where the rails are only imperfectly covered with earth; yet no trouble has been experienced with the joints as a result of contraction and expansion. In Chicago over 100,000 joints have been made and the number is constantly increasing. The Clark Street Electric line and other roads in that city have been entirely constructed with joints of this kind, and the result is said to be extremely satisfactory. The Consolidated Traction Company, of New Jersey, has also been making use of the joint in its new construction, and the Twin City Rapid Transit Company, of St. Paul and Minneapolis, has also been employing the system on a large scale.

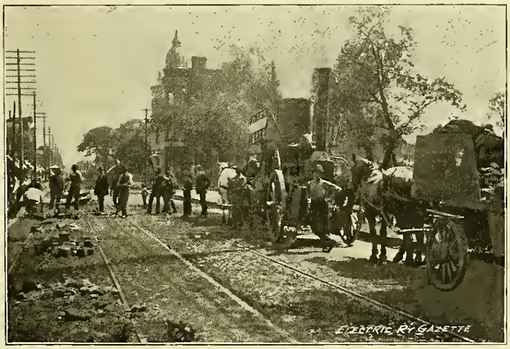


FIG. 1.—CUPOLA AND FURNACE.

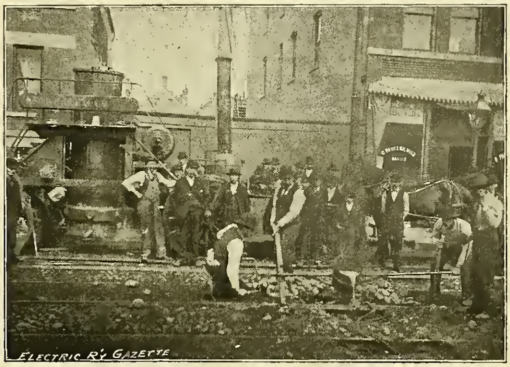


FIG. 2.—MAKING THE JOINT.

The process of making the joints is novel and interesting. The plant, Fig. 1, used in the work consists of a cupola, furnace and boiler mounted upon a truck, and a supply wagon which carries the iron, the fuel and the necessary water. The first step in the process is to enclose the abutting ends of the rails in specially prepared moulds. The molten iron is drawn from the cupola into a ladle, which is carried by three men to the joint, Fig. 2. The metal at this stage has a temperature of 2,500 degrees, and when poured into the moulds it registers not less than 2,200 degrees. This is so near the welding point that a perfect union results and the rail is made continuous. In the average joint for a 4½-inch rail 110 pounds of metal are used. It is cast in a long, oval-shaped slug extending for nearly a foot on each side of the joint, Fig. 3. For a 9-inch girder rail 135 pounds of metal are used to form the joint. It is claimed that by the use of the joints a smooth track is constructed, with the result that the life of the rolling stock and electrical apparatus is increased, repairs are reduced to a minimum, and riding on cars is made far more enjoyable.

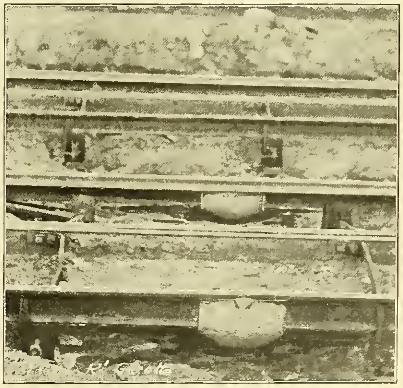


FIG 3.—COMPLETED CAST-WELDED JOINT.

Portland Power Transmission Plant.

Within the last few weeks two electrical plants for the transmission of power from waterfalls over long distances have been installed, one at Sacramento, Cal., and one at Portland, Ore. The latter plant was installed by the Portland General Electric Company, of which Mr. P. F. Morey is president. The company owns the water-power of the falls on the Willamette River, at Oregon City, 12 miles above Portland, which with a head of 40 feet has a capacity estimated at 50,000 hp. Part of the power has already been utilized by numerous factories and mills erected near by, and in addition to these an electric station, erected some years ago, has supplied current for lighting the streets and dwellings of Portland and for operating an electric street railway between Oregon and Milwaukee, seven miles away, the direct-current and high-frequency alternating systems being used.

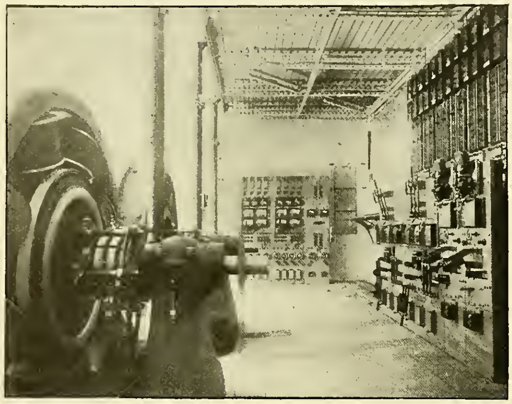


FIG. 2.—RECEIVING SIDE OF ROTARY TRANSFORMERS.

The station is located on the west side of the Willamette River, opposite the city of Oregon, and is being put up in sections. Twenty sections will complete the building; five are already built, and foundations are now being laid for the remainder. The ultimate generating capacity of the station will be 12,800 hp. The station building is of concrete, stone, iron and brick, and when finished will have a length parallel with the river of 364 feet. The water is taken from the canal on one side, led through an extensive hydraulic installation, and discharged into the river below on the other side. The water-wheel plant consists at the present time of three units, each consisting of a pair of vertical cylinder gate improved Victor turbines, one wheel being 42 inches and the other 60 inches in diameter. The larger wheel is brought into service only at periods of excessive high water, which the records show occur about once in every five years. The smaller wheel runs at a speed of 200 revolutions per minute and the larger at 100 revolutions per minute; both turbines are set at the same level, and the shaft of the larger wheel carries a pulley. The upper end of the 42-inch wheel shaft is provided with a coupling for connecting it with the shaft of the dynamo, which is mounted above it. The generator shaft carries a pulley in line with that on the shaft of the larger turbine, so that the smaller turbine may be uncoupled and the generator belted to the larger of the two wheels. When the smaller turbine is operated alone the belt lies upon a shelf surrounding the pulleys. Fig. 1 shows the interior of the station.

The weight of the vertical shaft with the armature is about 33,500 pounds, and to carry this a system of extra bearings is introduced, one of the ring-thrust type and the other a hydraulic oil bearing, both supplementing the ring bearings on the armature shaft. They are enclosed in cases filled with oil delivered by hydraulic pressure, and are surrounded by water jackets. The length of the generator shaft is 29 feet and it is 8⅜ inches in diameter.

Both wheels in each section are controlled by hand wheels and both are regulated by the same governor. The belt tightener is also controlled from either floor by a hand wheel. Water is admitted to the penstocks from the upper canal by means of a head gate operated from a platform on the canal side of the station. Each penstock is 10 feet in diameter and is constructed of riveted steel plates. Each wheel has its own flume, the water passing first through the large flume of the larger wheel to the flume of the smaller wheel, whence it passes through a tube into the tail race. In addition to these turbines there is an additional equipment, consisting of a set of pumps, including a hydraulic pump for supplying oil to the thrust-bearing cylinders and a duplex water pump to circulate the water in the cylinder water jackets. They are operated by two 15-inch horizontal turbines enclosed in the same flume.

For the operation of the exciters another pair of vertical turbine wheels has been installed, each 48 inches in diameter, driving the generators by a similar system to that already described for the operation of the large machines. The complete power plant will consist of 20 three-phase generators, with two direct-current machines acting as exciters.

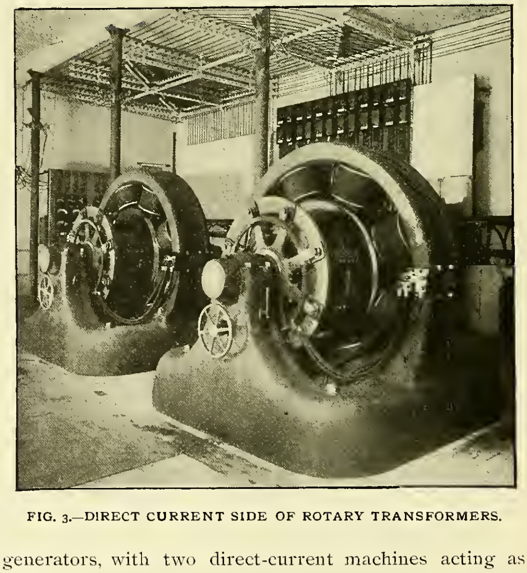


FIG. 3.—DIRECT CURRENT SIDE OF ROTARY TRANSFORMERS.

The five sections of the building already erected are occupied as follows: The first section contains the pumps and the accumulators for the complete station; in each of the three next sections is one three-phase generator of 450 kw capacity, and the fifth section contains two 250-kw multipolar continuous-current generators used as exciters.

One exciter is capable of supplying the fields of all of the 20 three-phase generators, the second machine being set up as a reserve in case of accident to the first. At present one of them is furnishing current to the street railways in Oregon City. When the station is complete the exciters will be removed from the fifth section and placed in the centre section of the building, where the switchboards will also be erected.

The generators are of special design and are set upon the floor of the station, the armature revolving in a horizontal plane, with one bearing at the floor line and another on top of the armature underneath the collector rings. Each generator has 20 laminated poles. The armatures are a little over seven feet in diameter and are about two feet high. They are constructed to deliver current to the line at 6,000 volts E. M. F. without the intermediation of step-up transformers. On account of this high voltage unusual precautions were necessary to perfect the insulation of the armature coils in order to avoid leakage to the ground. The armatures are wound with flat wire and each of the coils is divided into sections, each section being separately insulated. The armatures were subjected to a pressure of 15,000 volts alternating current, and were both short-circuited and open-circuited under full excitation, it is stated, without the slightest injury.

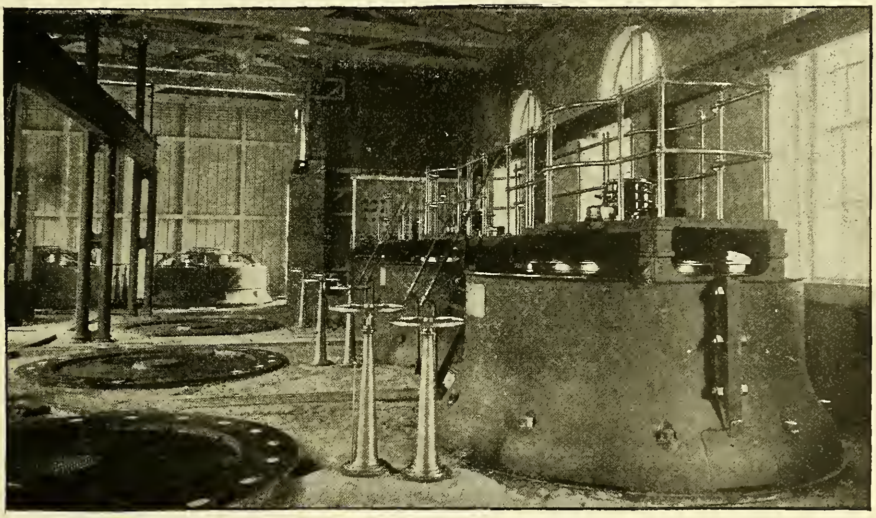


FIG 1—INTERIOR OF POWER STATION.

From the dynamos the leads are run to floor connectors and pass underneath the floor to the switchboard. The concrete floor is laid over them and thorough protection provided. The exciters are also of the vertical type, so that the armatures revolve in a horizontal plane; there is one bearing only, at the floor line. The construction of these exciters is almost identical with the General Electric multipolar type of railway generator, and each has a capacity of 250 kw at 125 revolutions per minute.

The line is 14.3 miles long, a separate circuit being provided for each machine. It passes through an undulating country following the course of the Willamette River as closely as possible. The poles upon which the three feed wires are strung also carry a number of wires for the 5,000-volt continuous arc current from the old transmission station, as well as the wires over which the old system of lighting with high frequency 5,000-volt alternating-current is effected. The loss in the long-distance transmission line is calculated at full load at about 11 per cent.

The sub-station to which the high-tension lines are brought is a two-story building, covering a space of 40 feet by 100 feet. The lower floor is divided into three rooms, one containing the transformers and the second the rotary converters, the other being used for a repair shop, lamp and meter room. The upper story of the building is occupied by the offices.

In the transformer room at present are 45 transformers, the receiving end of each line being connected to a bank of 15 transformers, five of which are placed between each pair of wires of the three-phase system. The transformers are mounted on an iron rack, five transformers high and three wide. Each set of five transformers is connected to the primaries in series and to the secondaries in parallel. The transformers are said to regulate at a little over 1 per cent. variation of the secondaries from no load to full load. The transformers are of the standard General Electric sub-station type, having numerous air passages between successive bunches of iron laminæ and between the coils so that they may be cooled by artificial ventilation. The distribution of light from the secondaries is effected on the four-wire system, which allows the working of synchronous and induction motors from the lighting mains. The four-wire system is worked at 1,000 volts between wires and by means of feeder regulators a variation of 4 per cent. in either direction is covered.

The direct current for the railway service is obtained by means of rotary transformers, Figs. 2 and 3. Two of these are at present installed in the sub-station, and space has been left for three more. Each converter will deliver 500 hp to the bus bars of the continuous-current switchboard.

The long-distance transmission lines for this railway service, as in the case of the lighting circuits, are connected to step-down transformers, transforming the current from 6,000 volts on the line to 400 volts at the secondaries, which feed the rotary converters; the rotary converters are compound for self-regulation, and run at 500 revolutions a minute.

At present the lighting from the three-phase system is used for large buildings containing several hundred lights each. They are close to the city station, and this distribution can be readily handled at about 400 volts. For the outlying and residential districts the high-frequency apparatus with individual transformers will still be employed. Continuous current will be furnished to the stationary motors already installed, but new motor installations will be made with the three-phase motors, which will be run straight from the three-phase switchboard, in parallel with the rotary transformer.

The railway current will be carried to the East Side Railway station by means of the cables under the Willamette River and this distribution will reach as far as Milwaukee, where connection will be made in parallel with 600-volt service from either Station A or Station B at Oregon City. The loop from Oregon City to Portland and back will thus be as follows: Beginning at Oregon City with 33-cycle three-phase current, at 6,000 volts 14.3 miles will be traversed as far as Portland; the current will then be reduced to 400 volts and passing through a rotary converter, issue therefrom at 600 volts continuous, which will be transmitted eight miles to Milwaukee and connect with the continuous current from Oregon City.

Underground Conduit System.

The advantages attending a system by which feeder wires are placed in underground conduits are obvious. Protection against cutting of wires during fire, by malicious persons during strikes, etc., is insured. Cost of repairs is reduced and delay, with consequent loss of traffic, are avoided. The system illustrated herewith is that of the Interior Conduit & Insulation Company of New York. Fig. 1 illustrates a system where the trolley wire alone is above ground. The trolley wire, the main conductor paralleling the trolley wire, the feeders leading from switchboard in power-house to the terminal points, and feeders leading from switchboard to track, are shown in the illustration. The circles represent junction boxes. In such a system all conductors may be placed in one underground conduit, excepting the trolley wire. At intervals of say 500 feet, a sub-feeder leads from the parallel main to the trolley wire, making a connection from the cables passing through the junction box through the medium of a pole tube. The method of setting a pole tube and the junction-box connection is shown in Fig. 2.

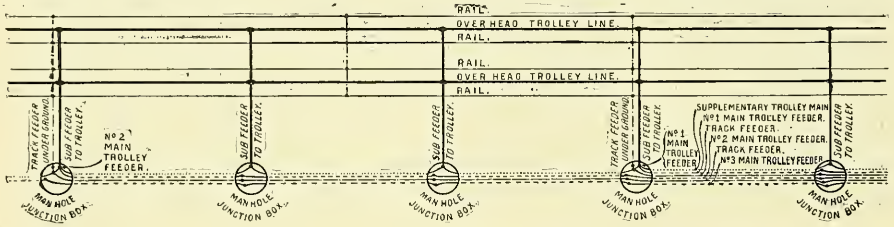


FIG 1.

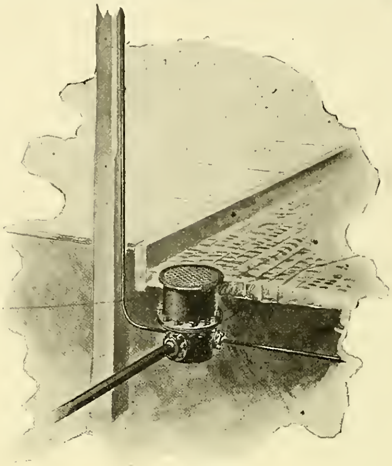


FIG. 2.

Fig. 3 illustrates a system without a main conductor paralleling the trolley wire. The other features of distribution are similar to Fig. 1, and the method of utilizing the conduits the same.

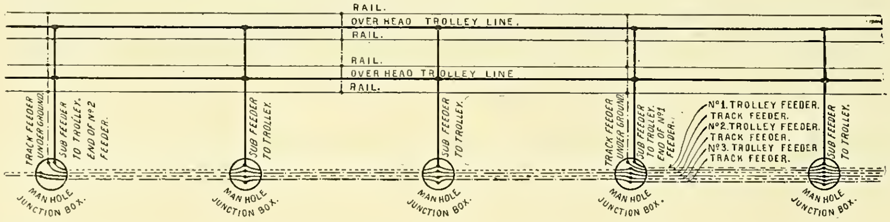


FIG 3.

Fig. 4 illustrates a series of junction boxes placed at intervals of 500 feet in the conduit system, with sectional flexible cables drawn through a duct of the conduit and electrically connected throughout, forming a continuous conductor.

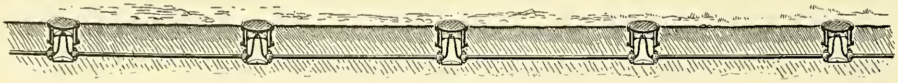
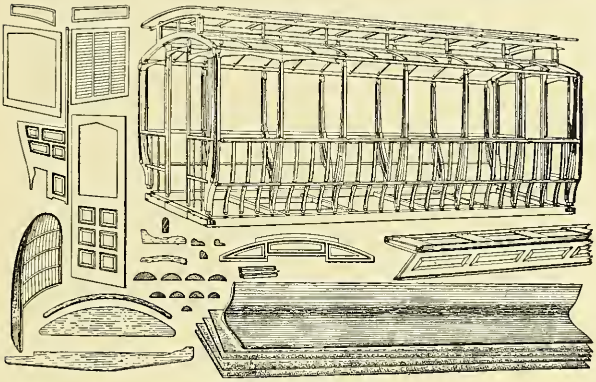


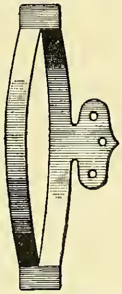
FIG. 4.

Street Car Woodwork.

To meet the demand of a great many companies which prefer to make their own cars, J.B. Sjoberg & Co., of New York, are now supplying the necessary woodwork. This makes it possible for the companies to follow out their preferences in this respect and reduces the work to a minimum. The accompanying illustration shows the parts of the car constructed with this purpose in view. When the material is shipped "knocked down" the freight charges are reduced to a minimum, as only 10 per cent. of the space occupied by a finished car is required. The several parts are readily assembled, and if care is taken that the joints are properly white-leaded, the durability of the cars will be insured. It has been claimed that an advantage exists in building cars in this way as the woodwork may be inspected carefully before it is painted. The manufacturers claim that the work of assembling the parts can readily be done by the men who are ordinarily engaged in repair work. The statement is also made that most street railway companies have sufficient shop room for assembling the cars, so that no provision in this respect is ordinarily required. It is explained that a very considerable saving in the cost of rolling stock can be made by the purchase of the parts and assembling them in the manner described.



PARTS OF STREET CAR

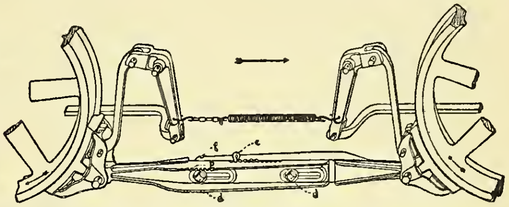


SASH SPRING.

The same firm is also manufacturing the patent sash and blind spring, shown in the illustration. It is elliptical and the two members are offset laterally, so that one may be inserted between the sash stile and the pillar stop, while the other is connected to a footplate fastened to the sash stile. In this way a simple and reliable spring is formed which prevents the sashes and blinds from rattling and presents the additional advantage that it does not cut into the parting strips of the pillars, as the friction is on a smooth round surface. The springs are made as stiff as may be required to suit the different sizes of windows and blinds in use.

Carter Brake.

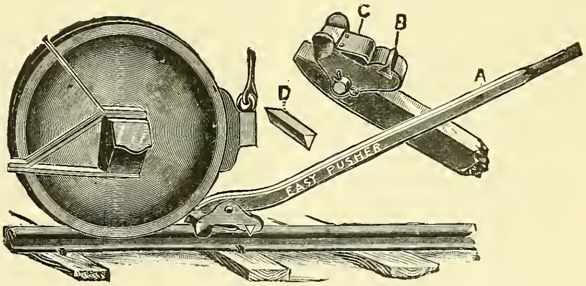
The process of braking a car is to destroy energy, which is costly to produce and wasteful to dissipate, but in the case of stopping a railway car this must be done. With the usual system of hand brakes the motorman exerts himself to set the brakes, and it is his force alone, magnified by means of levers, that is useful in this regard. The ideal brake is that which turns the energy against itself. The brake shown in the accompanying cut is designed on this principle. The revolving wheels of the car are utilized to set the brakes. The bell crank levers apply the shoe to the wheel, and tend to force it upward. The surface of the wheel revolving upward also causes the lever carrying the shoe to jam the latter tightly against the surface of the wheel. The brake is therefore semi-automatic, and at the same time possesses the reliability of the old hand brake. It is apparently devoid of complication, and also light, and it is claimed to be very effective. The brake is made by the Carter Brake Company, Chicago, Ill.



OPERATING MECHANISM OF CARTER BRAKE.

Car Mover.

The pusher which is shown in use in the illustration has lugs at the heel extending downward on both sides of the rail so as to hold it firmly in position and prevent it slipping sideways. The triangular bit or steel marked *B*, cuts into the rail when pressure is applied, and prevents slipping backward, even though the rail is icy, greasy or wet.



CAR MOVER IN USE.

This bit can be inverted until the three points are dull, and then sharpened. When the pressure is released the steel spring *C*, lifts the sharp steel bit from the rail, thus saving it from being dulled by sliding over the rail when following the wheel. The pusher is five and one half feet in length and weighs 20 pounds. It is manufactured by the R. Woodman Manufacturing & Supply Company, of Boston, Mass.

FINANCIAL NOTES.

PHILADELPHIA & FRANKFORT ROAD WINS.—City Solicitor Kinsey, Philadelphia, has forwarded to Council, through Clerk Kochersperger, an opinion setting out that it is too late for the city to prevent the Philadelphia & Frankfort Railway Company from maintaining its road through Northwood Park, and that all that the city can do is to require the company to make compensation for the land taken.

THE CITIZENS' TRACTION LEASE.—At a special meeting of the stockholders of the Citizens' Traction Company on last Monday night the lease of the Penn Avenue system to the Widener-Elkins syndicate for 950 years was ratified. The property will change hands Nov. 1. The annual rental is to be $180,000, payable semi-annually for the full term of the lease. Practically the only opposition to the deal was from the small stockholders.

CONSOLIDATED TRACTION.—The Consolidated Traction Company of New Jersey has made in earnings, gains which have finally placed the property in position to meet all obligations promptly. Last month the earnings were larger than in any preceding month in the history of the company, aggregating $245,538, against $201,885 in September, 1894, and $148,013 the same month in 1893. The returns so far this year have shown a steady improvement as compared with 1894 and 1893, and, with the exception of February, each month has gained over the preceding month.

LONG ISLAND TRACTION.—The work of reorganizing the Long Island Traction Company, of Brooklyn, has not progressed as satisfactorily as the committee in charge had hoped. One of its number, however, is reported by the Brooklyn *Eagle* as saying that the complications which are presented are more numerous than had been anticipated. One serious condition which faces the committee is that the Brooklyn Heights Railway Company is not earning as much money as it did last year. The transfer scheme has not yet begun to be a source of profit to the company, and it has been found that it presents to the conductors an almost unlimited field for dishonest operations.

STREET RAILWAY EARNINGS IN PHILADELPHIA.—Earnings of the various traction companies for September show encouraging gains, notwithstanding the fact that comparisons, in most cases, are made trolley with trolley. Philadelphia Traction's gross earnings last month increased $30,000, the comparison being made wholly of lines operated by the same power—electricity. This also applies to Baltimore Traction, the earnings of which for the month increased about $22,000; and in both cases these increases are practically net gains, for the reason that there is little, if any, difference in operating expenses. People's Traction, on the other hand, reports total gross earnings of $194,103, against $137,331 for September, 1894, an increase of $56,771, or an average daily increase of $1,832. A year ago, however, this company was not operating its Old York Road division, the average earnings of which are about $1,500 a day. The Election Traction in September increased $80,000; in August the increase was $90,000. The statement of earnings of the Hestonville, Mantua & Fairmount Passenger Railway Company for the month of September shows gross earnings from the Arch Street division of $35,461, an increase of $16,914, and from the Race Street division, $8,438, an increase of $5,782. The number of passengers carried over both divisions during the same month aggregated 908,744, an increase over September, 1894, of 467,428 passengers.

NEWS OF THE WEEK.

QUARRYVILLE, PA.—It is proposed to build an electric road between this place and West Chester.

SCRANTON, PA.—An ordinance has been passed by the Common Council giving the Valley Passenger Railway Company the right to extend its tracks to Petersburg.

SHERMAN, N. Y.—A. B. Minton, of Westfield; F. A. Ellis, J. L. Thayer and T. S. Harmon, of this place, are interested in a movement to build an electric street railway.

FREDERICK, MD.—The Frederick & Middletown Electric Railway Company has obtained a franchise. Under the terms of the grant the company must build the road within two years.

HOLLIDAYSBURG, PA.—Interested parties are circulating a petition urging the extension of the Altoona City Electric Railway to connect with the Logan Valley line. The petition is being generally signed.

DETROIT, MICH.—The electric railway to Mt. Clemens has proved so formidable a competitor that the Grand Trunk Railway has reduced its fare to that point to less than one half the rate which has heretofore prevailed.

OWEGO, N. Y.—An electric line will be built from this place to Speedsville by the Owego & Northern Electric Railway Company, recently organized. It is probable that a branch will be built to Candor and Spencer also.

TACOMA, WASH.—The City Park Railway Company and the Tacoma Railway & Motor Company have asked for franchises for the extension of their respective systems, and it is regarded as a foregone conclusion that the requests will be granted.

BAY SHORE, L. I.—A franchise to construct a trolley line between this place and Brentwood has been petitioned for by George B. Studley and A. J. Martin. If the franchise is granted it is probable that the line will be extended to Oakdale and Babylon.

JACKSONVILLE, FLA.—It is reported that an electric line will be constructed between Jacksonville and St. Augustine by the Jacksonville & Tampa Bay Railway Company, in which Martin Dodge and Charles C. Thompson, Cleveland, O., are interested.

HAMILTON, ONT.—The directors of the International Electric Radial Railway Company have asked Waterdown for a bonus of $20,000, and asked East Flamboro' to give $50,000. It has been stated that if the company does not come down at least one half in its request the Township Council will not submit a by-law to the ratepayers.

CROTON-ON-HUDSON, N. Y.—The Croton Valley Electric Railway Company will construct a narrow-gauge street surface railway, about four miles long, from the New York Central Depot in Croton-on-Hudson to the new Cornell Dam. Charles E. Grattan, Edward White, Robert B. Wright, and others, of this place, are interested in the project.

SAGINAW, MICH.—There are three projects in the field to build electric railways between Saginaw and Bay City and work has begun on two. The third and last scheme contemplates the construction of an electric railway to Bridgeport, six miles out. The Township Board has granted a 30-year franchise to the Saginaw Street Railway Company.

NEW ORLEANS, LA.—The City Council has adopted the ordinance providing for advertising for bids for the extension, for a term of 50 years, of the franchises of the Canal & Claiborne Railway Company. With the rebuilding of the Canal & Claiborne Railway, and its equipment as an electric road, which will no doubt promptly follow the sale of the franchise, the mule will disappear permanently from the streets of New Orleans as a motive power in passenger transportation.

TRADE NOTES.

GEO. C. EWING, 620 Atlantic Avenue, Boston, is handling a complete line of superior railway specialties, the quality of which, together with his indomitable energy and courteous dealing, is having a telling effect with the trade, winning friends and customers right and left. Mr. Ewing's street car headlight has been adopted by the West End Railway Company, and all its cars are being equipped with it. This headlight is also finding favor throughout the trade.

THE BILLINGS & SPENCER COMPANY, Hartford, Conn., has accepted the selling agency of the Kelsey Electric Railway Specialty Company's manufactures, which, in connection with the excellent railway material of its own manufacture, covers a strong list of desirable specialties incident to railway equipment.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., has just completed a new storeroom for the Hartford Rubber Works, a new car-house for the Norwalk Tramway Company, at South Norwalk, Conn., and a new generator house for the Burlington (Vt.) Gas Light Company. The company reports work as very brisk in all its departments.

NEWALL & KNOWLTON, of Peabody, Mass., prominent manufacturers of greases and dealers in leather, make a specialty of extracting greases from leather belts. If belts slip because of being saturated with oil or grease, this firm guarantees to extract the deleterious substance without injury to the belt and make the latter run as good as when new.

THE OKONITE COMPANY, LTD., of New York, is making a specialty of feeder wires for street railway use, the insulation of which is tough and tenacious and claimed to be not affected by extreme changes in temperature. "Okonite" has made an enviable record both in this country and abroad and is deservedly one of the most popular insulations known to the electrical fraternity. It is strictly high-grade, and "never disappoints."

EXTENSIVE PREPARATIONS are being made by the Chicago Electric Wire Company, of Delaware, for the manufacture of all kinds of electric light and railway wires, cables, etc. The company has put in a comprehensive outfit of machinery for the production of high-grade rubber insulation and its application to the wire, as well as 100 braiding machines. Offices have been established in the Hale Building, Philadelphia, under the efficient management of Mr. E. T. Davis.

MR. C. B. PEAR, of A. & J. M. Anderson, Boston, has returned from a short but thoroughly enjoyable vacation in Europe. Mr. Pear is an excellent representative of that class of younger workers in the electrical field to whom a large measure of credit is due for the great advancement made in the electrical trade during its comparatively short existence. He not only stands well with the trade but enjoys the most complete confidence of his firm, of whose large business he has full charge of all details.

THE BALL ENGINE COMPANY, of Erie, Pa., is distributing an unusually fine piece of advertising work in the shape of a pamphlet containing engravings showing numerous styles of Ball engines, some of them direct-connected to generators of various types. The engravings are beautifully executed, and the pages are further embellished with tasteful border work of appropriate design, making the little book thoroughly entertaining from the artistic, as well as the purely practical, standpoint.

THE MASSACHUSETTS CHARITABLE MECHANICS' ASSOCIATION opened its triennial exhibition to the public on Wednesday morning, Oct. 2, and will continue until Nov. 30. As this exhibition also marks the centennial of this organization the opening exercises were of exceptional interest and in which representatives of the state, city, general government and educational interests generally participated. The exhibits of manufacturers, industries, and mechanics are varied, in which, of course, electricity conspicuously figures.

THE FERRACUTE MACHINE COMPANY, of Bridgeton, N. J., has recently sent to the General Electric Company two monster stamping presses, one of which is capable of cutting a rectangular blank of sheet metal eight feet long and four feet wide. The smaller of the two will cut a round blank 24 inches in diameter. These two presses are special machines, and are provided with cast-steel columns in place of the usual iron. This shipment makes seven of these extra heavy presses that have been bought by the General Electric Company, one of them being sent to the company's branch factory in Germany. All of them are reported as giving complete satisfaction.

THE GRAHAM EQUIPMENT COMPANY, of Boston, has just received several important orders from the South for its well-known truck and other railway manufactures, and reports business all round as exceedingly good. Mr. J. H. Graham, its manager, is the personification of energy, and has not the slightest conception of a state of idleness. If he is not looking personally after business, he is exemplifying his hearty belief in judicious advertising by the circulation of interesting literature descriptive of his valuable electric railway specialties. "Electric Railways and Other Ways" is the title of one of his most recent leaflets, introducing in nutshell form the important features of the Graham truck, including Graham's equalized brakes, and illustrations of Graham's spring-suspended steel-frame car and steel push snow-plow, with descriptive matter. Mr. Graham reports that the steel-frame cars are giving most excellent satisfaction at Tampa, Fla., and that inquiries regarding them are increasing every day. One of these cars will be on exhibition at the Montreal convention.

"P. & B." COMPOUNDS AND TAPE will be in evidence at the Montreal convention next week, as they are in every place where electrical work is found. The tape, which has been adopted by the New York Central Railway Company for reinsulating its cables in the tunnel, in conjunction with the compound, has firmly established its claim as a high-grade insulating medium. This tape does not dry out and unwrap, but adheres firmly to the surface to which it is applied and remains elastic and waterproof. Then there is the "P. & B." cloth, which has rescued so many railway superintendents from insomnia. Five years ago this article was introduced; now it is considered well-nigh indispensable in well-regulated power-houses and electric railway car shops. It is made by saturating strong canvas with a special compound made for the purpose, which does not bake hard and render the canvas stiff and unmanageable. Mr. Maurice Hoopes, electrical engineer for the Lynn & Boston Railway Company, writes the manufacturers that his company's experience with the motor cloth has been entirely satisfactory. Concerning "P. & B." varnish, Mr. Albert Schmid, superintendent of the Westinghouse works, writes: "We are using 'P. & B.' on all of our coils, and I consider it the best insulating and waterproofing material I have ever used." The few people who are not familiar with the various "P. & B." products can find full information in the catalogue issued by the manufacturers, the Standard Paint Company, No. 2 Liberty Street, New York.

Record of Electric Railway Patents.

UNITED STATES PATENTS OCT. 1, 1895.

547,018. STREET OR OTHER RAILWAY CAR REGISTER; John J. May, Pittsburg, Pa. Filed March 29, 1895. This is an automatic register combining an L-shaped step and an L-shaped plate or tread provided upon its under side with guides upon which are arranged springs for supporting the plate. The step is provided with posts or stops limiting the downward movement of the plate. There is a register in the car and a suitable connection is made between the register and a lug on the plate or tread projecting through a slot in the stop. The L-shaped step with the correspondingly shaped tread forms a closure for the springs, guides and stops.

547,031. CONTACT FOR ELECTRICALLY PROPELLED VEHICLES; Emil B. W. Reichel, Charlotteburg, Germany, assignor by mesne assignments to the Siemens & Halske Electric Company, of America, Chicago, Ill. Filed April 4, 1894. Patented in Italy Dec. 18, 1893. This patent covers the familiar horizontal arm extending transversely to the trolley conductor and adapted to make contact therewith. A bar or strip of anti-friction metal is mounted on the face of the arm.

547,061. RAIL SWEEPER; Henry A. Bruhns, Milwaukee, Wis. Filed Feb. 11, 1895. The car is provided with vertically adjustable bearings in which a shaft is arranged. There are a clutch-controlled sprocket wheel and link-belt mechanism between an axle of the car and the shaft and spindles in loose sleeve are in connection with the shaft. The brushes are loose on the spindles, geared connections being made between the shaft and the brushes and suitable provision for tilting the spindles.

547,068. ELECTRIC MOTOR TRUCK; William G. Gaither and William R. R. Gaither, Chicago, Ill. Filed Nov. 10, 1894. The truck comprises side bars having seats formed thereon, and the cross bars have their ends arranged in the seats and adjustably supporting plates for the ends of the cross arms are also arranged in the seats. Springs are interposed between the plates and cross bars and means are provided for retaining the plates in place.

547,077. ELECTRIC RAILWAY REPAIR WAGON; Anthony Iske and Albert Iske, Lancaster, Pa. Filed Dec. 18, 1894. The wagon body has parallel side rails secured to the top faces of bolster bars, which are adapted to be mounted on running gears. There are guide slots in the forward portions of the rails and in them a rod is movable back and forth. A winding shaft has its ends rearward of the slots, journaled in the inner faces of the parallel side rails, and chains have their joined rear ends secured to the movable rods within the slots, mechanism being provided to rotate the shaft and also to hold it in any rotated position. A ladder and brace bar supporting standards are secured to the tops of the side rails toward the forward and rear ends thereof. The wagon body is adapted to support the ladder and crossing brace bars centrally pivoted together, and a rotatable platform is pivoted to a framework resting on rollers secured to the front and upper ends of the ladder and brace bars. Lazy-tongs arms pivotally connect the centre of the framework with the ladder and brace bars above their pivoted centres.

547,080. AUTOMATIC SWITCH FOR RAILWAYS; August Klawon, Jackson, Mich. Filed March 19, 1894. This is a combination of a switch and actuating mechanism therefor. A cross bar has a cam and a switch bar has a limited movement on the cross bar, and is provided with a vertical extension having notches. A switch-locking bar is operated by the cam to release the switch.

547,091. CAR BELL; William O. Snyder, New York, N. Y. Filed Sept. 5, 1894. The plunger of the bell is adapted in its downward and upward movement to actuate a trip, so that a horizontal shaft with a spring attached thereto is rotated, and then set in motion by means of a train of gears, a vertical shaft carrying bell clappers or tongues, which are alternately rotated first in one direction and then in the other.

547,096. CAR WHEEL AND METHOD OF PRODUCING SAME; William J. Taylor, Bound Brook, N. J. Filed July 16, 1895. The wheel has a steel tread provided with a tapered body joined to the body of the wheel and a chilled flange, the body and flange being of the same metal.

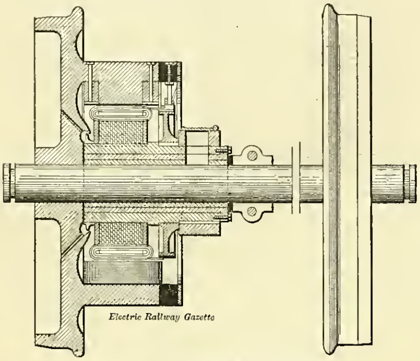
547,134. SNOW AND ICE FLANGER; Charles Russell, Missoula, Mont. Filed Feb. 12, 1894. The frame is rigidly connected to the truck, and ice flangers, or knives and mold boards, are connected to the frame and adapted to be raised and lowered. A rod connects the flangers and mold boards with a lever, and a rod connected to the lever has an enlargement which is engaged with spring-pressed lever jaws, which hold the flangers and mold boards in a raised position.

547,157. CAR GUARD; Simon A. Politsky, Boston, Mass. Filed Jan. 21, 1895. Vertical guards are attached to the platform, and with them a guard is engaged, which is adapted to slide vertically thereon. Operating devices are connected with the guard and the platform, so that the guard may be raised or lowered. Brake shoes are adapted to act on the car wheels, and connections are provided between the guard operating devices and the brake shoes, so that the latter are applied to the wheels when the guard is lowered and removed when the guard is raised.

547,166. CAR FENDER; William Grunow, Jr., Bridgeport, Conn. Filed Aug. 3, 1894. An approximately semi-circular frame is suspended from the car truck beneath the car platform in alignment with the centre of gravity. A rectangular tray having its rear end pivoted in the frame projects forwardly therefrom and arms or extensions depend from the frame. Stop pins project inwardly therefrom and the tray rests upon the pins. Both the frame and the tray are of substantially open or skeleton form.

547,218. STREET CAR FENDER; James D. Lamb and James D. Chapman, Montreal, Canada, assignors of one twentieth to John James Durack, same place. Filed Nov. 17, 1894. The fender has a stationary back piece and an intermediate section pivotally connected therewith. An oscillatory forwardly projecting frame section is pivotally supported about midway of its length and its forward end is adjustable vertically to different heights relatively to the roadbed. Means are provided for supporting it at its pivoting point, and a lever device engages its rear end for operating and adjusting the projecting frame section.

547,247. SAFETY GUARD FOR STREET CARS; Carl Eidmann, Brooklyn, N. Y. Filed April 4, 1895. The guard consists of a scoop having a concave sloping body, and a curved bar is connected with the top of the body and has pivotal extremities. The horizontal forward extension of the lower end of the body has a cushioned front edge and the front and side plates stiffen the sides. The scoop is pivoted in the truck and has means for normally supporting it above the track and for lowering it so that it may be put into use, and also has wheels for running on the track when lowered.



NO. 547,323.—ELECTRIC MOTOR.

547,258. SAFETY GUARD FOR CARS; Harlan H. Henley, San Francisco, Cal., assignor to the Henley Car Fender Company, same place. Filed June 14, 1895. An inclined apron projects in front of the car and is adapted to receive an object or obstruction and lift it from the surface. Tips are connected with the apron which are adapted to move over the surface beneath. A device is provided by means of which when the tips are forced backward, they are raised to pass over an immovable object which they may come in contact with.

547,283. TROLLEY AND TROLLEY POLE; Wilbur L. Pepper, Philadelphia, Pa. Filed Dec. 29, 1894. Telescoping sections of rods are pivoted to the upper section and pivoted levers have their upper ends pivoted to the rods a short distance from the lower ends of the latter, their lower ends being weighted. There are elongated staples on the upper ends of the levers and springs are provided having one end secured to the ends of the rods and the other ends loosely connected with the staples and levers.

547,302. ELECTRIC MOTOR FOR STREET CARS; William Stine, Omaha, Neb. Filed Jan. 11, 1895. The electric motor continuously revolves and its armature shaft is provided with worms at each end. Gears are mounted below the car and mesh with the worms. The gears are mounted upon driving shafts, there being one driving shaft upon each side of the electric motor. The driving pulley is mounted loosely upon the driving shaft in belt connection with the car axles. A clutch mechanism is mounted upon the driving shafts and is provided with an extending curved collar. A duplex operating bar is provided with four projecting shoes, two of which simultaneously working within the collars alternately actuate the clutch mechanism, so as to cause the power shafts to revolve in opposite directions.

547,304. CONDUIT SUPPLY SYSTEM FOR ELECTRIC RAILWAYS; George Tolmie, Carbon, Wyo. Filed July 10, 1894. Metallic projections are supported normally out of contact and are provided with a collapsible moisture-proof casing. A weighted pivoted lever has a movable projection at one end, which is provided with a conductive facing and is attached to the casing. Electrical connections are made between the facing and one of the points within the casing. There are electrical connections between the opposing point within the casing and a feed conductor, and a collector is adapted to engage the projection on the lever and depress it so as to establish contact between the points within the casing.

547,308. CAR BRAKE; Josiah A. Webber, Brooklyn, N. Y., assignor to Harry W. Douty, Asbury Park, N. J. Filed July 9, 1895. There is a series of pairs of pivoted brake levers and flexible brake straps connect them. There are brake shoes on the straps and means are provided for connecting alternate pairs of brake levers with the crank arms of the opposite ends of the car, and stops to limit the movement of the brake levers in one direction.

547,312. CAR FENDER; Alexander S. Williams, Long Island City, N. Y. Filed Oct. 12, 1894. The fender has its body composed of rods or bars hinged together to form a lazy-tongs structure adapted to be collapsed and distended. The front bar is secured to the forward edge of the lazy-tongs structure, and means are provided for supporting the front bar from the car, so that the fender is maintained in position when distended.

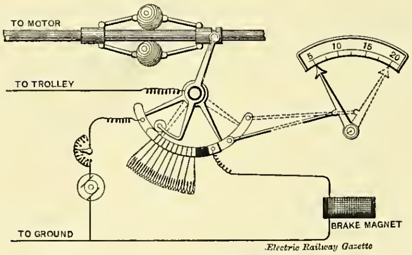
547,321. CAR FENDER; Horatio N. Black and John W. Keeler, Philadelphia, Pa. Filed Dec. 21, 1894. The fender consists of a cross beam and an angular frame supported therein, a pliable strap secured at its ends to the cross beam and passing around the frame. Springs are interposed between the angular frame and strap and bear against the latter, and a floor is secured to the frame.

547,323. ELECTRIC MOTOR; Addison E. Boggs, Allegheny, and Fremont J. Cleaver, Beltzhoover, Pa. Filed Jan. 4, 1895. A field magnet is secured to one side of the wheel and an armature is mounted upon the axle. A commutator wheel is mounted upon the boss of the armature, and has an insulated ring on which are placed commutator bars. An insulated ring is secured to the pole-pieces of the field magnet and inwardly extending studs are secured to the insulated ring and carry brushes. Metallic rings are secured to the face of the insulated ring and are connected with the studs. (See Illustration).

547,366. CAR FENDER; William Wossoff, Philadelphia, Pa. Filed Jan. 18, 1895. A backing is secured to the frame of the fender and the latter projects downwardly therefrom, having its front end composed of a pneumatic tube with coil spring backing. The rock-shaft is supported in bearings below the dashboard, and slide bars are connected at the lower ends to the tube in front of the fender having racks upon their upper ends. There are spur gears on the rock-shaft which mesh with the racks and a pick-up mechanism is normally retracted below the fender, comprising a scoop composed of an upper and lower shovel hinged together. There are connections between the rock-shaft and the scoop for thrusting it forward beyond the fender and means are provided for opening the shovel to raise the body into the fender. Connections are provided between the rock-shaft and the main driving shaft of the car for positively operating the rock-shaft.

547,369. DEVICE FOR CONTROLLING SPEED OF ELECTRIC CARS; James Brady, Brooklyn, N. Y. Filed June 24, 1894. A speed governor is used, having operating connection with the motor or its driven shaft or axle. A manually-adjustable device is operated by the governor and is adapted to automatically regulate the flow of current through the motor. An indicator suitably connected to the current-regulating device is adapted to be moved only by the manual adjustment thereof, so as to indicate the rate of speed to which the motor is regulated. (See Illustration.)

547,372. RAILWAY SWITCH; John A. De Vilbiss, Quincy, Ill., assignor of one third to James P. Cusak, same place. Filed April 24, 1895. The switch has a pin on its upper face and a vertically movable spring-actuated rod is secured to the dashboard. On the lower end of the rod a shoe is carried, adapted to move the pin so as to engage the switch. There is a heel extending back to the line of the rod whereby the rod is turned by the switch pin and thrown back into place.



NO. 547,369.—DEVICE FOR CONTROLLING SPEED OF ELECTRIC CARS.

547,379. RAILWAY CAR TRUCK; George B. Joughins, Berkley, Va., assignor of one half to Edward Cliff, Newark, N. J. Filed Dec. 12, 1894. The side frames of metallic truck frame are formed from beams, and the jaw or pedestal is constructed by cutting into shape, splitting up and opening out the end of the side frame with an attached piece of metal to restore the strength of the beam.

547,393. SWITCH OPERATING DEVICE FOR STREET CARS; Jesse A. Crandall, Brooklyn, N. Y., assignor of one half to Augustus C. Halsey, Oscar Halsey and William S. Linniker, same place. Filed Feb. 23, 1895. A vertically movable and rotatable shaft is supported on the car and has one side of its lower end cut away. The wheel is journaled upon the cut-away part of the shaft and is beveled at its periphery, so that one of its sides will be of less area than the other. The side of the smaller area is brought adjacent to the cut-away part of the shaft and is approximately in the same vertical plane with the axis of the shaft.

Electric Railway Gazette.

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FROM many points of view the Convention of the American Street Railway Association, which opened in Montreal last Tuesday, was the most successful meeting in the history of the organization. The attendance was even larger than had been anticipated. Just how many persons were attracted to the city by the Convention it was not easy to estimate, as a considerable number failed to register their names, but the attendance certainly did not fall much below 1,000, and the gathering therefore may be regarded as the largest in the history of the Association.

The residents of Montreal were lavish in their hospitality, and every visitor must have left the city with the pleasantest remembrances of his brief stay. Every facility was afforded the delegates to see what was of interest in the city, but the time was too limited to permit them to finish the programme of sightseeing. The exhibit of street railway apparatus and supplies was in every respect creditable. It had been feared that manufacturers would not avail themselves of the opportunity of exhibiting their goods on account of the distance, and because of the possibility of delay and annoyance attending custom house inspection, but it appeared that few were deterred by these considerations. Victoria Rink, which was engaged for exhibition purposes, is a large building, and all the desirable space was occupied. Although the structure proved undesirable on account of the extreme cold, the exhibitors could not complain that they were neglected by the delegates. Most of the latter made a careful inspection of the great variety of displays.

H. M. LITTELL,
President of the American Street Railway Association.

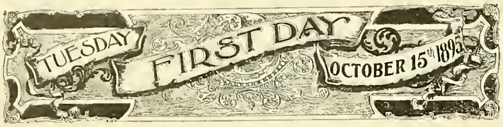
The Convention was not as productive of as many set papers as usual, but the sessions were not devoid of interest by any means. Several topics of vital importance were discussed with unusual interest and spirit. Definitive action was taken on several matters which have been agitating the members for the last year. The arrangements for the Convention were in almost every respect admirable, and the Montreal committee deserved the thanks of the Association for the capable manner in which it discharged its multiplicity of duties.

The members were not satisfied with entertaining their guests for four days, as provided in the original programme. They decided on their own responsibility to add a fifth day to the meeting, and those who were able to prolong their stay enjoyed an unusually pleasant excursion.

The business sessions were held in Windsor Hall, which is located in the same building as the headquarters of the Association, and the rink where the exhibits were made was conveniently near. The social features of the convention were unusually enjoyable, and in some respects were novel as parts of a street railway convention. It was a noticeable fact that an unusually large number of ladies were present at the meeting, and to this fact, perhaps, the success of the social side of the convention is largely to be ascribed.

Interest in the business meetings centered in the plans for liquidating the debt of the Association and in the question of admitting the supply men as associate members. The debt was paid by voluntary subscription, and after an extended discussion it was decided not to change the character of the membership. New officers were elected and those upon whom the burden of responsibility will fall during the ensuing year are the president, H. M.

Littell, president of the Atlantic Avenue Railway Company, of Brooklyn, and the secretary and treasurer Thomas C. Penington, treasurer of the Chicago City Railway Company.



ADDRESSES OF WELCOME.

After the convention had been called to order, Mayor Villeneuve, of Montreal, gave an address of welcome. He said :

"It is to me a pleasant task, as Mayor of this city, and on behalf of the citizens of Montreal, to extend to all a most cordial welcome. You have assembled in our midst to hold the fourteenth annual meeting of your organization, and I assure you that our city considers itself honored by your presence. Your Association, considered in its object, and in the result of its labors, is undoubtedly one of the most important on the American continent, and so rapid has been the development of the electrical industry that few have been able to keep track of its achievements. Its improvement has been a wealth producer; it has cost individuals and communities large sums of money, but this in every case has produced more than the cost, and it has been cheaper to have these improvements than to do without them. This fact cannot be questioned, and the isolated cases of failure in practical experiments, or poorly calculated investments, are but the sacrifices by which the general good has been advanced. I think I may venture the statement that the electrical industry has produced more changes in the American service and convenience of civilized life than has ever been caused by the use of any other method or force, subject to the service of man.

T. C. PENINGTON,
Secretary and Treasurer of the American Street Railway Association.

"There is probably no application of electric power which has attracted closer attention from those whose interest is affected by it, than its use for operating street railways, and in no other branch of service has electric power achieved a more brilliant success. I therefore beg to congratulate you, gentlemen, because you are members of an Association whose object is to develop, confirm and extend such an important industry, and I pray you to consider yourselves at home in our city—the Metropolis of Canada. I trust your convention will be fruitful, and will result in benefit to yourselves as a body and to the community at large. Rest assured that, one and all, the citizens of Montreal appreciate fully the honor you have done them in selecting their city as the scene of the present convention, and they trust that when you return to your homes you will take back with you pleasant and lasting memories of Montreal!"

GRANVILLE C. CUNNINGHAM,
First Vice-President of the American Street Railway Association.

In responding to the welcome President Hurt said: "Such generous words of greeting are to be taken as sufficient license to see and enjoy all that is to be seen in your beautiful city. This Association represents one of the great industries of the country. Its members are called upon to daily meet grave and perplexing questions, and probably in that direction it taxes its managers more than any other line of work."

Alderman S. C. Stevenson, of Montreal, was introduced by the president, and gave a second address of welcome, saying in part:

"You are just as welcome as if you were in your own city; and if you enter any of our homes you will be as gladly welcomed as at your own fireside. You have fallen into good hands, considering that you are in the city of Montreal—a city that can undertake anything in the way of receptions, and usually carry them out in a style not second to any I have ever seen anywhere else. But even if the citizens do not do their full duty, you have fallen into good hands—the Montreal Street Railway Company—whose officers will no doubt treat you as well as they are treating the citizens at present, and if you are as well pleased with their efforts as the citizens are, I think you will have no ground for regretting that you came to this good city."

President Hurt followed with an address as follows:

ADDRESS OF PRESIDENT HURT.

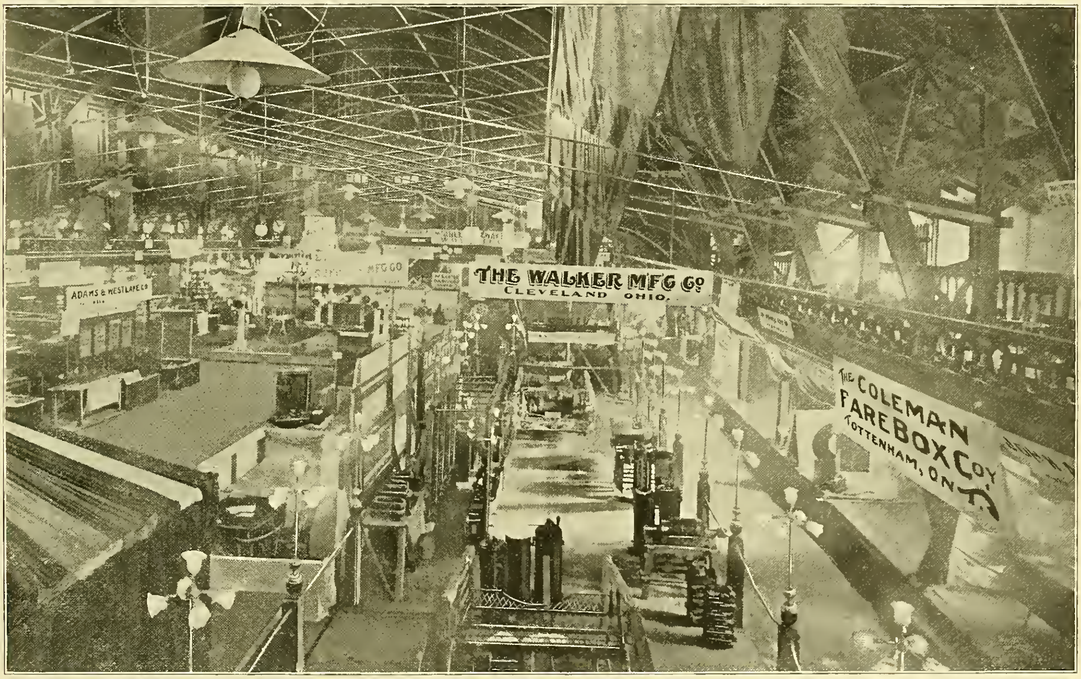
You are for the first time in convention beyond the confines of the States, and by this meeting on Canadian soil the lesson is taught that the Association is endeavoring to extend and receive the benefits, fraternal intercourse, and broad educational work.

The street railway problem of to-day is growing in importance more rapidly and is attracting to a study of its solution a greater number of educated men than any other branch of industrial work. But a few years have sufficed to transform a business of dull drudgery and routine, in which animal power was resorted to chiefly, into a business in which the mysterious power "Electricity," but by a distinguished scientist dominated "God vice-gerent," works man's bidding at all sections of an immense system with instantaneous promptness. The usefulness of this subtle will force is only equaled by the charm of its contemplation, and the ablest men of the day give homage to a business which invokes its application.

There are in operation to-day in the United States about 179,300 miles of steam roads, and about 13,500 miles of street railways. The passenger receipts on the steam roads the past year were $276,031,000. The gross receipts on street railways in the United States were between $125,000,000 and $140,000,000.

The street railway mileage of the United States is about 7½ per cent. of the steam railway mileage, and passenger receipts of street railways about 45 per cent. of the passenger receipts of steam roads.

The total capitalization, bonds and stocks of steam roads in the United States is about $11,000,000,000, and of the street railways about $1,300,000,000. The latter being about 11 per cent. of the former, while the profits of the steam roads were $322,000,000, and on the street railways about $43,000,000, the latter being about 13½ per cent. of the former. From these figures an idea may be gathered of the magnitude of the business.



GENERAL VIEW OF THE STREET RAILWAY EXHIBITION AT MONTREAL.

There are many questions which call for more extended and complete work. There are new branches of business to be cultivated by the companies, such as the handling of freight and mail, the delivery of small parcels from retail stores through a system of express, the handling of building material to suburban localities, the handling of milk on special cars for the purpose, and the operation of funeral cars from any portion of the system into cemeteries where special facilities are provided.

The companies will need to lend mutual aid to each other through the national association for the purpose of defeating hostile legislation in national, State and municipal governments, and to conduct a work all along the line which will tend to implant in the minds of the patrons of the roads the fundamental idea that the public interest demands friendly legislation for transportation companies, since this will tend to enable the companies to furnish the best and most rapid transportation, while hurtful legislation will tend to bring about the opposite result.

The relation of street railways to steam roads is growing more interesting and in some localities even perplexing, until the question is now being asked, what will be the solution of the extension of electric lines which are cutting so rapidly into the business of the steam roads? A partial consideration of this question brings forth the inquiry, Will not the interests of these two systems of transportation force an amalgamation of the systems, having thereby the main lines connecting distant points, and which will be operated into stations at convenient points in municipalities from which passengers will be transported over various street railway lines to their destination?

The steam roads of the country are organized, the territory being subdivided into several sections for the purpose of promoting harmony and mutual protection. While it is true that street railways do not now come into competition with each other, except to a limited extent, yet it is a question if their interests do not demand an organization with sufficient strength and facilities to keep a constant watch over the business throughout the country. It is believed that the time has come when a larger revenue must be raised either upon the assessment plan or by increasing the membership dues.

The great and important question before you here is the one to enlarge the scope of the Association. The Executive Committee has held three long sessions, two in this city and one in New York, the time being devoted chiefly to a consideration of this question. Seven days and nights have been spent in these meetings, the result of which will appear in the committee's report, and to which your attention is invited.

TREASURER'S REPORT.

The report of the treasurer was read and showed the following figures: Receipts, $7,554.57; expenses, $7,240.55; balance on hand, $314.02.

AFTERNOON SESSION.

Mr. E. J. Wessels read his paper on the "Present Status of the Air-Brake," which, with the discussion, appears elsewhere in this issue. The following discussion on papers took place:

PAVING STREETS.

MR. SEELY: I would like to ask about street paving. I will state our case specifically. In building a railway in a certain city, the railway company is compelled to pave its strip 18 feet in width with the same material that the city officials pave the remaining portion of the street, which happens, in this case, to be asphalt. In paving this street, the paving contractor refused to do the paving unless we entirely suspended our service, taking all cars off. He paved one piece, and after that was done, the railway company decided it would not give up the street. The paving company has refused now to pave that portion of the street, claiming that it could not be done while the cars were in operation. The railway company has commenced to put in that concrete itself, keeping the cars moving at the same time. I am pleased to say that it is quite successful so far. Of course, it is expensive. The next problem is who will pave the top of the concrete with asphaltum. The railway company is thinking seriously of constructing a plant of its own.

Mr. Johnston, of Richmond: In the work under my charge in Philadelphia I have had paved a great many miles of street paving; there we do the work under contract. In that city the authorities require the street railway companies to pave the whole street, not merely a strip. Our bills amount to a good many hundreds of thousands of dollars. In no case have we given up the street to the contractor. It is a piece of utter contrariness on the part of any contractor who says that he cannot lay the paving without stopping the cars. We put in a concrete paving between and alongside the rails, and we have done $500,000 worth of this work. I did the paving in New Orleans, Philadelphia and Richmond. In Richmond we are going to put in a track laid on concrete, and do not propose to stop one minute.

I will say further, that some years ago I was assistant city engineer in Richmond, and had charge of the paving. The contractors did the work and the cars never stopped running a minute.

Mr. McCulloch: We pave between our rails and one foot outside, and between double tracks, with the same material with which the street is paved. No contractor or paver ever asked us to discontinue the running of the cars. It would not be tolerated by the Board of City Works in our city. It is not necessary, and is unreasonable.

The convention adjourned to Wednesday morning.

The Convention was called to order by President Hurt at 10:45 a. m., Wednesday, and went into executive session. The first topic for discussion, "The Labor Question," was taken up, the discussion being opened by Mr. C. D. Wyman, of Milwaukee, who was followed by Gen. W. H. Jackson, of Nashville. The discussion was suspended to admit of the reading of a communication from Mr. Baumhoff, of St. Louis, enclosing a paper on "Transfers." Both letter and paper were read, and on motion the paper was ordered to be spread on the minutes and printed. The discussion on the subject of "Transfers" was opened by Mr. Sergeant, who was followed by Messrs. Charlton, McCulloch, Jackson and Hurt. The discussion of the labor question was then resumed, Messrs. Sergeant, Wyman, McCulloch, McClary, Charlton, Hurt, McLean and Connette taking part. An adjournment was then taken until 2 p. m.

AFTERNOON SESSION.

A letter was read inviting the members to attend the performance at the French Opera Theatre Thursday evening, and the invitation was accepted with thanks.

Mr. Hamilton read the report of the Executive Committee together with the amended constitution proposed by the Executive Committee. The report was received and a vote of thanks was extended to the committee. The report in substance was as follows :

REPORT OF THE EXECUTIVE COMMITTEE.

In discharging the duties imposed in the by-laws of your Association, a call was made for a meeting of the Executive Committee, to be held in Montreal on February 27, last. Messrs. Hurt, Bean, Hamilton, Cunningham, together with Secretary Richardson, were present. It was found impossible to obtain the presence of the one additional member necessary for a quorum, and it was decided by those present to discuss informally the work laid out by the Association at its last annual meeting, with a view to submitting a definite plan to another meeting of the Executive Committee, to be held as soon thereafter as possible. The subcommittee spent three days in this work.

Shortly after its adjournment Secretary Richardson was taken ill, and on April 26 he died. The committee has thus been denied the great advantage of Mr. Richardson's experience in the association's work, and has been not a little hampered in its efforts to properly handle the detail work connected with the present Convention.

A second meeting of the committee was held on May 15 in New York City, and was attended by Messrs. Hurt, Jackson, Hamilton, Payne, J. H. Cunningham, Bean, G. C. Cunningham and Partridge, Mr. Harrison only being unable to be present. Mr. T. K. Glenn, Secretary of the Atlanta Consolidated Street Railway Company, acted as secretary of the meeting, without compensation.

The committee found to its surprise, that the Association was largely in debt, its liabilities exceeding its assets by nearly $5,000. These liabilities were found to be the accumulation of several years, in which the sum of the actual expenditures and the bills contracted but not settled had exceeded the receipts. It did not appear, however, that there was any extravagance in the conduct of the Association's affairs. The receipts have merely been insufficient to take care of all the work laid out by the Association at its annual meetings. The chief criticism that the committee has to make, is that the situation had not long before been faced and a course of action determined upon, which would prevent the annual increase of debt.

The records and property of the Association contained in the office of the Association in Brooklyn, were examined by the committee and found to be well kept and in good condition, Mr. Richardson's assistant, Miss Strickland, being in charge.

In view of the plans presently to be referred to for enlarging the scope of the Association, and the committee being unwilling to forestall the action of the Association at the present Convention, it was determined to appoint a member of the committee to act as secretary *pro tem.* of the Association without compensation until the annual meeting in October, and Col. John N. Partridge was so appointed. Miss Strickland, who had been for some years Mr. Richardson's assistant, was engaged to act as Col. Partridge's assistant in charge of the Brooklyn office until the annual meeting. Mr. Richardson's salary for the month of May was voted to his widow. Col. Partridge was requested to have the association's books audited and a report made to the Executive Committee. Col. Partridge was also instructed to resort to urgent methods for the collection of unpaid dues and other sums owing to the Association, and as a result of his efforts a substantial reduction has been made in these accounts receivable.

The treasurer's report has been made up for the 11 months and 15 days, from Oct. 15, 1894, to Sept. 30, 1895, and shows, in brief, a deficit of $4,087.33.

At the last annual meeting your Executive Committee was instructed to take into consideration the advisability of recommending a plan for the enlargement of the scope of the Association. After much consideration of the subject, a resolution was passed by the committee that "the scope of the Association be so extended that a bureau of information be created for the purpose of collecting and disbursing statistical and general information as to the management and operation of railway properties, insurance, legislation, and investigation of legality and value of patents, and such other matters as may from time to time be referred to it by the Association or its Executive Committee."

In order to carry out the provisions of this resolution, a sub-committee was appointed at the New York meeting to draft certain amendments to the constitution and by-laws of the Association. This committee presented its report at a meeting of the Executive Committee held in Montreal yesterday, October 14th, and practically the entire time of the committee was given up during the day and evening to a most careful consideration of every suggested change. The results of the committee's deliberations are found in the revised constitution and by-laws, which are submitted to the Association as embodying the best thought which the committee has been enabled to give to problems which directly affect the Association's welfare.

On the question of admitting associate members and the method of raising dues, Mr. Harrison, of the committee, voted nay.

In making these changes the committee has endeavored, first, to vastly increase the useful work of the Association for the benefit of its members, and, second, to provide the necessary funds for the accomplishment of this work in such a way as to place the burden justly, and in a manner such that they can be borne easily and without the slightest difficulty, by large and small companies alike. Radical action has been avoided, together with a too sudden increase of responsibility on the part of those charged with the undertaking of the new work, it being the committee's belief that the Association should proceed carefully and step by step, towards the far larger field of usefulness which lies within its eventual reach.

The committee recommends to the Association that the present custom of issuing banquet tickets to delegates in attendance be abolished, and that in future a uniform charge of five dollars for each ticket be made to all members and others who desire to attend the banquet.

Membership.—At the opening of the meeting in the city of Atlanta there were 173 member companies. As the result of changes, there are now 166 members.

Street Railway Law.—Judicial decisions and opinions have been issued during the year, and constitute parts of Volumes XI. and XII., 1894.

Obituaries.—It is with a sincere feeling of sadness and a sense of personal loss that we again speak of the death of one who has been, since the birth of the Association, one of its most prominent members and officers. Mr. William J. Richardson was known to every street railway man in the country as an honorable, high-minded man, and one whose influence has always been exerted in behalf of the highest ideals of business and personal action. Mr. Richardson was born in Albany in 1849. In 1876 he became associated with his father, the late William Richardson, in his railway interests in Brooklyn, and until recently has been for many years an official of the Atlantic Avenue Railway Company of that city. He had been secretary and treasurer of the Association and of the Street Railway Association of the State of New York since their organization.

Ex-Gov. Oden Bowie, president of the Baltimore City Passenger Railway Company, died at his home on Dec. 4, 1894, of paralysis. Mr. Bowie was 68 years of age at the time of his death. He was a captain in the Mexican War, was elected governor of Maryland in 1867, and was elected president of the Baltimore City Passenger Railway Company in 1873.

Thomas M. Sayre, who was for 14 years superintendent of the Jersey City & Bergen Railway Co., died on July 28, 1895, of typhoid-pneumonia. He has been connected with the company named for 31 years.

An adjournment was taken until 4:30 p. m. to enable the members to attend the reception given by McGill University at 3 p. m.

On reassembling at 4.50 p. m. the chair accorded to Mr. Harrison the opportunity of giving an explanation which he desired to make respecting his non-concurrence with the report of the majority of the Executive Committee upon some items embraced in its report. A discussion followed in which Messrs. Harrison, Hamilton, Jackson, McCulloch, Thompson, Hurt, Cunningham, Wyman and Fairchild took part. On motion of Mr. Wyman it was agreed that the report as read by the Executive Committee be spread in full on the minutes, that it be printed and a copy thereof sent to each member of the Association, and that action thereon be deferred until the next regular meeting of the Association.

A resolution proposed by Mr. Littell that a committee of seven be appointed by the chair to nominate officers for the ensuing year was adopted. On motion of Mr. Harrison a committee of ten was appointed to devise ways and means for raising the deficit in the Association treasury. The motion was carried. An adjournment was then taken until 10 o'clock on Thursday.

The Convention was called to order in executive session by President Hurt at 10:45 a. m. The Chair announced the following committees: On Ways and Means: R. B. Harrison, H. M. Littell, T. H. McLean, W. Y. Soper, H. M. Watson, Charles Odell, Charles Green, E. C. Goodrich, T. C. Penington, John N. Akerman. On Nominations: C. D. Wyman, Milwaukee; Charles S. Sergeant, Boston; John D. McClary, Birmingham, Ala.; W. J. Thompson, Camden, N. J.; Edward Lusher, Montreal; John A. Seely, New York; Henry Scullin, St. Louis.

The secretary read a letter inviting the delegates of the Convention to hold their next meeting at Saratoga.

Capt. McCulloch extended to the Association an invitation to meet next year in St. Louis. He said: "We offer the Association the hospitalities of St. Louis, for the next Convention. Ten years ago you were there and we entertained you under such disadvantageous circumstances that we feel that we would like to do it over again, and do it properly. We were in the midst of the only strike that we ever had, and at the time you were there there was not a car in either city. We have a good many running now, and while we do not wish to boast, we will say that we are not behind the times in anything, and when you come there you will find everything with us as modern and as varied as you will find it anywhere else. We have both cable and electric cars, and we have them in as good shape and condition as we know how to put them. We will try to entertain you as hospitably as we did ten years ago, and I believe you were all satisfied with everything except our operations of our roads at that time."

The secretary read a letter from Mr. Frank R. Greene, secretary of the Chicago City Railway Company, inviting the Association to hold its next Convention in Chicago. In the course of the letter Mr. Greene said: "If the Committee will consider cities that have already had the Convention, then we think our city has a strong claim, as Chicago had practically the first Convention. Chicago has over 600 miles of street railway, and owing to its central location, presents an ideal place for holding the meeting. In the event of the Association coming to Chicago, we suggest that an exposition of Street Railway Appliances be held, similar to the exhibitions held heretofore, only on a much larger scale, and that it be made as large and attractive as possible, in order that the general public will patronize it generously. In this way we are confident that the Association will realize enough money to pay off its existing debt."

A communication was received from Mr. W. J. Hammer, of New York, submitting a copy of the preamble and resolutions adopted by the Committee on Standard Rules for Electrical Construction and Operation of the National Electric Light Association. Mr. Hammer, by the permission of the Convention, spoke briefly in support of the request made in his letter for the co-operation of the American Street Railway Association with the National Electric Light Association in securing the adoption of one standard code of rules for electrical construction and operation, and for the appointment of a representative from the Street Railway Association to serve upon the proposed joint committee.

On motion of Mr. E. H. Davis, of Williamsport, the Executive Committee was authorized to appoint a delegate on behalf of the Street Railway Association.

A paper by Mr. N. W. L. Brown on "Cross Ties and Poles" was, on motion, received and ordered to be printed. It appears elsewhere in this issue.

The following report of the Committee on Patents, Mr. F. R. Greene and Mr. J. W. McNamara, was presented and appears elsewhere in this issue. It was referred to the Executive Committee.

Mr. Seely offered a resolution expressing the Association's cordial approval of the plan of the National Electric Light Association to hold in New York City next Spring at its annual convention, a comprehensive exhibit of modern electrical inventions and applications depending on the use of central-station and power-house current, with the object of increasing popular interest in electric lighting and allied arts. The resolution was adopted.

AFTERNOON SESSION.

Vice-President Cunningham called the meeting to order at 2.20 p. m. The report of the Committee on Ways and Means was presented by the chairman, Mr. Harrison, and was discussed at great length. The report and the discussion relative to the admission of supply men as associate members of the organization appear elsewhere in this issue. Subscriptions for liquidating the debt of the organization were asked for and $4,475 was pledged for this purpose.

The nominating committee presented the following recommendations for officers for the ensuing year, and recommended St. Louis as the next place of meeting:

President, H. M. Littell, Brooklyn, N. Y.
First vice-president, Granville C. Cunningham, Montreal.
Second vice-president, William H. Jackson, Nashville, Tenn.
Third vice-president, J. Willard Morgan, Camden, N. J.
Secretary and treasurer, T. C. Penington, Chicago, Ill.
Executive Committee: Joel Hurt, Atlanta, Ga.; Prentiss Cummings, Boston, Mass.; C. G. Goodrich, St. Paul, Minn.; A. Markel, Hazleton, Pa.; W. F. Kelly, Columbus, O.

The report was adopted.

The Committee on the Use of Salt and Sand on Street Railway Tracks, D. G. Hamilton and Robert McCulloch, presented the following report:

The use of salt on the rails at certain times and during certain conditions of weather is absolutely necessary in order to clear the rails of a film of ice that will otherwise form on them. Without the use of salt it would be very unsafe to operate cars on a hilly system during the Winter, and your committee is of opinion that no road can afford to dispense with its use. Salt has been used on street railways throughout the United States constantly while horse cars were in vogue, and now more than before is its use imperative in the operation of electric cars.

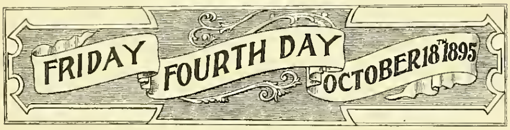
In like manner, sand is a necessity on the rails in order to give the wheels a "proper grip" on the track.

In the city of St. Louis, Mo., the quantities of salt dumped on the tracks is in excess of 3,000 tons in the course of one Winter. There is no objection on the part of the local authorities or health board to its use, and but for the use of this salt it would be impossible to operate our cars. The use of sand is also absolutely necessary, and its use is not interfered with in any manner, any more than is the use of salt.

The thanks of the Convention were extended to the president, vice-presidents and members of the Executive Committee and Mr. E. E. Higgins, the temporary secretary.

Messrs. Watson, Hamilton and Goodrich were appointed a committee to draft a suitable resolution of thanks to the citizens of Montreal for their hospitality.

The Convention adjourned until Friday morning at 10 o'clock.



FRIDAY FOURTH DAY OCTOBER 18 1895

The president called the meeting to order at 11 o'clock. The subject of "Furnishing Free Music and other Entertainment by Street Railway Companies to the Public," was announced, and the following discussion took place:

Mr. McLean, of Indianapolis: The Citizen's Railway Company, of Indianapolis, owns the only park of any size in the city of Indianapolis, which comprises 265 acres, and we find it very profitable during the Summer to give entertainments there, particularly in the way of band concerts, and they have attracted many thousands to the park, especially on Sunday afternoons and evenings.

Mr. McClary, of Birmingham: We have a park of about 100 acres, with a lake 33 acres in size, with pavilion, walks and drives, and every week-day night except Saturday, during the Summer, we have a band playing music for dancing. Every Sunday afternoon we have a sacred concert, and find it profitable.

Mr. Scullin: I would like to ask if it is not a fact on account of these large crowds congregating all at one point, and being desirous to get away in a short time, there is not a greater liability for accidents, especially in putting on extra cars and allowing green men to handle them. I would like to ask the gentlemen who have spoken on the subject if they have had any such experience.

Mr. McLean: So far as our road is concerned, we have been free from accidents at these unusual gatherings. We had the encampment of the State militia in our park this Summer, which resulted in a very handsome gain in receipts, and it taxed our facilities to the utmost to carry the people to and from the park during that week, and there was not a single accident.

Mr. McClary: We have never had an accident in carrying away these crowds that collect at the parks on account of these entertainments. For two years we have had the State militia encampments, and had as many as 8,000 people at a time in the grounds, to bring away at one time, as soon as we could get them away, and have never had an accident.

Mr. Hurt: As the result of special inquiry on that very point I have gathered the impression that during the time that large crowds gather for pleasure at resorts of this kind every one is on the *qui vive*, so to say, and there are fewer accidents and less disposition to make complaints to the companies, and if an accident does occur we are less liable to hear from it than on ordinary occasions.

Mr. Penington: I understand on "Chicago Day" at the World's Fair we carried 800,000 people, and the most serious accident we had was that someone shoved a man off a car and hurt his arm. The cars were crowded so that we could not make a pickup from one car to another, on account of the fenders rubbing on the ground. It seems at a time like that as if everybody were on the lookout and avoided danger.

Mr. J. F. McElroy addressed the meeting on the subject of "Electric Heaters for Street Railway Cars," illustrating his remarks with a number of diagrams.

On motion of Mr. Harrison the meeting passed a vote of thanks for the remarks, and requested Mr. McElroy to revise and amplify them for publication in the proceedings of the meeting.

The Committee on Resolutions presented a report expressing the appreciation of the Association of the many acts of hospitality and courtesies extended them by the citizens of Montreal and by the officials of the Montreal Street Railway Company.

The chair appointed Messrs. Hamilton and Harrison a committee to escort the newly elected president and secretary to the platform. They were duly installed and acknowledged their election with thanks, and pledging their best efforts in the development of the Association.

The meeting then adjourned, to meet in St. Louis the third Tuesday in October, 1896.

SOCIAL FEATURES

RECEPTION AT MCGILL UNIVERSITY.

The delegates and visitors at the Convention attended a reception given by the governors of McGill University on Wednesday afternoon. The guests were received in the engineering building and were given an opportunity to inspect the several departments. Students and instructors acted as ushers and took great pains to see that all parts of the building were examined. There is much of interest to see in the institution. In the hydraulic laboratory one of the most prominent objects was a large plunger pump, which supplied water to a reservoir apparatus for determining the flow through an orifice. A hydraulic device for producing vortex rings in colored water attracted much attention.

In the adjoining laboratory, for testing strength of materials, were displayed a 175,000-pound emery testing machine of the vertical type, and a 200,000-pound testing machine adapted for transverse stresses as well as tension and compression.

In the electrical department the authorities have shown marvelously good judgment in the selection of dynamo-electric machinery. The best American and foreign types are represented, and it would be hard to find a greater variety in types assembled in one building. A Willans engine with the upper cylinders removed was driven by a directly-connected dynamo operated as a motor, and the peculiar valve motion of the former was thus shown very clearly. The engineering laboratory was equally well equipped with apparatus. The shops consist of departments for carpenter, machine and forge work and a foundry; students were busily at work in all the departments during the reception. It was learned that students are required to make apparatus that will be useful to the institution, and none of the work is sold. During the reception, the students were at work on a compound air compressor.

In the foundry about 1,800 pounds of work are turned out every two weeks. The capacity of the cupola is two tons. There is a fine assortment of mathematical instruments and driving engines.

On the upper floors are located physical, magnetic and other laboratories and draughting rooms, and on the top floor a complete collection of pneumatic switches are shown.

THE BANQUET.

The banquet took place on Thursday evening in the main dining hall of the Windsor Hotel. It was an unusually interesting occasion. The attendance was large, and the responses to the toasts were timely and were well received. The tables were adorned with palms, ferns and potted plants, and English and American flags were effectively used for decorating the room. President Joel Hurt occupied the chair of honor. On his right were Chief Justice Sir Alexander Lacosli and Dr. Anderson, United States consul-general, and on his left were Mayor Villeneuve and Senator Olgilvie. After the dinner President Hurt proposed the toast, "Her Majesty the Queen," and was followed by Dr. Anderson, who responded to the toast, "The President of the United States." Other toasts were responded to as follows: "The City of Montreal," Mayor Villeneuve; "American Street Railway Association," Alderman Stevenson, of Montreal, and Hon. Louis Beaubien; "Montreal Street Railway," Granville C. Cunningham; "Our Guests," Sir Alexander Lacoste and Senator Olgilvie; "The Ladies," J. H. Stedman; "The Technical Press," C. W. Price; and "The Next Merry Meeting," Col. J. H. Cunningham.

THE EXCURSION TO OTTAWA.

The Convention, according to the original programme, was to continue for four days, but the hosts of the Association decided to lengthen it and arranged an excursion to Ottawa to take place on Saturday. A special train of seven coaches carried the visitors to the capital, and on arriving there special cars, provided by the Ottawa Electric Railway, conveyed them to the Parliament Buildings, where a reception took place in the Senate chambers. An address of welcome was delivered by the premier, Sir Mackenzie Bowell. He expressed the hope that the Americans would go home with a better opinion of the Canadian people than they had entertained. He alluded to the significance of the Convention, and remarked that when people of different nationalities were brought into contact, the effect would, he was sure, prove of a widening nature.

J. H. Gallinger, of New Hampshire, was introduced to reply to the address of welcome. The delegates were present, he said, to cultivate the spirit of amity which existed between Canada and the United States. The time had long passed for strife on the North American continent. The Americans loved Canada, he thought, a great deal more than Canadians realized, and while the Republic might once in a while cast longing eyes in the direction of Canadian soil, the governments of both countries had come to a realization of the fact that there is room for two great nations in North America to exist side by side in terms of the closest friendship.

At half-past twelve the delegates partook of lunch at the Russell House, and were afterward taken charge of by officials of the Ottawa Electric Railway, who placed special cars at their disposal. They returned to Montreal by special train in the afternoon.

The Gazette's Convention Bulletins.

For the first time at a street railway convention, the Gazette issued each day during the four days of the Montreal meeting a Bulletin, giving a brief report of the proceedings, the names of those present and an idea of the different exhibits. On the last day an extra Bulletin was added, making five published in all.

When the delegates on the special train from New York reached the Windsor Hotel on Tuesday morning, although the Convention had not yet been called to order, Bulletin No. 1 was all ready to hand them.

This Bulletin consisted of four pages of the size of the Gazette and contained even their own names, with particulars regarding exhibits to be made at Montreal so complete that some of it had been received by telegraph.

That the Bulletin was popular is putting it mildly. The fact is that every one was delighted to see the first number, while each subsequent issue was so eagerly sought after that although the editions were increased it seemed no easy matter to keep up with the demand for copies.

Wednesday's Bulletin was actually distributed about the hotels and at the exhibition hall in Victoria Rink on Tuesday evening; Thursday's issue was similarly distributed on Wednesday evening, and Friday's on Thursday evening, much to the delight of the delegates and supply men who, instead of writing long letters home at the end of each day, found time for but a few lines, and were glad to add "for further particulars see inclosed Bulletin of the Convention proceedings."

After the adjournment on Friday a second Bulletin for that day—No. 5—was issued. This consisted of eight pages, and in addition to a brief report of the closing meeting contained a synopsis of the matter that had appeared in Bulletins 1, 2, 3 and 4. This eight-page Bulletin was mailed to subscribers and readers of the Electric Railway Gazette, that they might know at the earliest moment what had been done at the Montreal meeting, the names of the officers elected for 1895–96, and where the next convention was to take place.

The Exhibits.

The exhibit of street railway apparatus was made in Victoria Rink, which adjoins the Windsor Hotel, the headquarters of the Association. The floor space was well occupied, and the exhibits well represented the wide range of materials now required in street railway operation and maintainence. The manufacturers took the utmost interest in this feature of the Convention, and a vast deal of attention was paid to the arrangement and decoration of the booths. The effect of the display was extremely attractive. The only drawback lay in the fact that the building was not heated and the temperature was sufficiently low to suggest that the Canadian winter had already commenced. A great number of the street railway men faithfully attended the exhibition and noted carefully everything that had been arranged for their inspection. The supply men owed particular thanks to President Hurt, who on several occasions emphasized the importance and significance of the exhibits and urged all the delegates to spend a liberal portion of their time in the rink. In the following paragraphs will be found brief notices of the exhibits:

Mr. C. W. Henderson, of Montreal, exhibited a line of electrical supplies.

Mr. E. D. Julien, of Montreal, exhibited a model of a combination Winter and Summer car.

Mr. C. C. Kaufman, of Kingston, N. Y., exhibited the Kaltenbeck street car fender, for which many claims are made.

H. R. Ives & Company, of Montreal, exhibited several types of the Hinphy car fender. Mr. W. J. Hinphy was in charge.

Mr. A. W. Gassford, of Montreal, exhibited a line of trolley wheels, car fittings for open and closed cars, valves and engineers' brass work.

Mr. George E. Smith, of Sherbrooke, Que., exhibited his new machine for bending rails. By its use a uniform curvature is given to the rail.

Mr. A. Roy MacDonald, of Montreal, decorated his booth with mica in all shapes and forms and arranged the rear portion of his space in a way to represent a mica mine.

Morris, McCurdy & Smith, of Indianapolis, Ind., exhibited samples of the Phœnix rubber insulating paint, and Mr. Elmer P. Morris explained to visitors the peculiar merits of the compound.

The Bushnell Company, of Montreal, displayed in a handsomely arranged booth, a full line of its lubricants. Mr. George J. Kilpin and Mr. Frank R. Greene were the company's representatives.

Mr. E. F. de Witt, of Lansingburgh, N. Y., was kept busy in exhibiting the sand box which is known by his name. The device has been very popular, and Mr. de Witt says that no fault could be found with the prospect for business.

The Cambria Iron Company, of Philadelphia, Pa., showed a collection of rail sections of different heights and weights designed for all conditions of street railway service. The New York representative, Mr. William A. Washburne, was in charge.

The Chloride Accumulator interests were represented by Mr. Arthur E. Childs, the New England agent. Every one knows these batteries, and Mr. Childs did his best to extend their reputation. Success was of course realized in this regard.

The Weber Rail Joint Company, of New York, showed in its space its new rail joint applied to different heights of girder and T rails. The joint is designed to afford relief to those who have been striving to solve the problem of keeping up joints.

The John A. Roebling's Sons Company, of Trenton, N. J., made an exhibit of various types of wires and cables, the merits of which are recognized by electric railway companies generally. The company was represented by Mr. Doyle and Mr. Cockey.

The McPherson Sand Box Company, of Troy, N. Y., exhibited two of its new sand boxes, which on account of their efficient operation attracted a great deal of attention. Mr. Henry McPherson, the inventor, was present to explain the characteristic features of the appliance.

The St. Louis Register Company, of St. Louis, exhibited several of its Security fare registers, which are simple in construction, and are not liable to get out of order. The registers have been tested during a long period of service and have not been found wanting. Mr. Giles S. Allison, of the New York office, looked out for the company's interests.

The Portable Hose Bridge Company, of Detroit, Mich., which was represented by Mr. E. Grace, made an exhibit which illustrated an ingenius method devised to accommodate a fire hose. Provision is made for bridging over the hose so that the operation of cars may be continued when a hose is stretched across a street.

The Lobdell Car Wheel Company, of Wilmington, Del., made an exhibit which demonstrated that its wheels are made for long service. Two wheels were shown, one of which had traveled 112,750 miles and the other 117,057 miles. Both wheels were still in excellent condition. Mr. A. McLeod found that little additional argument was necessary to convince delegates that the company which he represented made wheels to last.

Mr. A. L. Daniels made an excellent exhibit of standard bushings, porcelain and earthenware insulators, made by the Akron Insulator Marble Company, of Akron, O. He also displayed a line of the goods made by the H. B. Camp Company, of Aultman, O. This company manufactures the well-known Crump vitrefied clay conduit which has been used by some of the largest telegraph and telephone companies in the country.

The Keller Printing Company, of New York, made an exhibit of improved fare and transfer tickets. A feature of the exhibit was the Keller patent dating machine, by means of which tickets are stamped with the date and hour of their issue. Some strong testimonials from companies which have used these machines show that their merits have been well appreciated. Mr. J. F. Bushe and Mr. E. R. Mills were the company's representatives.

The Fulton Foundry & Truck Company, of Mansfield, O., exhibited a complete model of one of its new trucks which are now giving such satisfaction in service. One of the company's efficient sand boxes was shown which delivers the sand as required in just the proper place and in the necessary quantity. Mr. W. E. Haycox, an old time street railway man, who has a keen appreciation of what is wanted in the field to-day, represented the company.

The Pennsylvania Steel Company made an exhibit of a Harveyized cast-steel frog. Its girder rails are now so well known that the company doubtless thought it wholly unnecessary to show specimens of them even if a sufficient number could be spared from the mill for exhibition purposes. Just at the present time the company is finding it a most difficult task to supply the demand for heavy girder rails. The company was represented by Mr. Mason D. Pratt, engineer of the street railway department, who was able to give some interesting information regarding Harveyized steel which the company is now using.

The Taylor Electric Truck Company, of Troy, N. Y., occupied a large space in the most prominent position in the rink. Among the features of the exhibit were two Taylor improved single trucks, one of which was equipped with a new adjustable safety guard. This is made of canvas in the form of an engine cow-catcher, and combines a number of good features which the manager of the Company, Mr. John Taylor, pointed out to visitors. Two Empire State radial trucks, one designed for two motors, and the other for a single motor, were also shown. Special attention was called to the method of applying the brakes. The air-brake may be used if desired. One of the exhibition cars, which was operated on the tracks of the Montreal Street Railway Company, was mounted on a Taylor improved truck and was equipped with No. 12 A Westinghouse motors. The car body was built by the Ottawa Car Company, of Ottawa, Ont.

The Westinghouse Electrical & Manufacturing Company was represented by a large delegation from its business and engineering departments. Among the representatives present were noticed: Mr. E. N. Sanderson, formerly of the Boston office, now of Pittsburg; Mr. B. F. Stewart, of Chicago; Mr. E. F. Gordon, of Charlotte, N. C.; Mr. H. A. Craigin, of New York; Mr. J. A. Rutherford, Mr. G. H. Lewars, Mr. Albert Schmid and Mr. E. H. Heinrichs, of Pittsburg; C. A. Bragg, of Philadelphia, and Mr. R. S. Brown, of Boston. The company's headquarters were at the Queen's Hotel, where the latest literature descriptive of Westinghouse motors and generators was distributed. A fine collection of photographs illustrating the Westinghouse apparatus was shown in Room 304 of the Windsor Hotel. Car 55 of the Montreal Traction Company had a special equipment of Westinghouse motors and controllers, which attracted a great deal of attention.

The Mica Insulator Company, of New York, arranged its space in a most attractive manner, using for this purpose micanite in a large variety of forms for all kinds of street railway insulation. A novelty in the way of a sign was shown at the rear of the space, consisting of a large sheet of micanite bearing the name of the company and illuminated by several incandescent lamps. Two interesting features of the exhibit were representations of a W. P. motor armature and the commutator for a large generator, both insulated entirely with micanite. Large sheets of micanite were shown, as well as commutator segments and rings, micanite cloth and paper and micanite in a great multiplicity of forms for insulating purposes. In the same space was located the exhibit of Eugene Munsell & Company, of New York, consisting of mica cut to size and in bulk, mica segments for all railway motors, and mica insulation for other purposes. Mr. Charles E. Coleman was in charge of both exhibits.

The Consolidated Car Heating Company, of Albany, made an exhibit which was attractive for more reasons than one. The warmth which was distributed from heaters arranged as if in a street car was exceedingly grateful to the visitors. The various styles of electric car heaters were shown and their characteristic features were explained by Mr. J. F. McElroy, the engineer of the company, who is an authority on electric heating. The space was brilliantly illuminated by incandescent lamps, mounted on boards, and the lights served a useful purpose in illustrating the heating system. The lamps were connected to one of the five-point switches which, in heating, are designed to deliver five different intensities of current to suit the various changes in the weather. By the manipulation of the switch the lamps could be dimmed or made brilliant, in accordance with the amount of current delivered to them. The exhibit attracted a great deal of attention. In addition to Mr. McElroy, the company was represented by Mr. H. N. Ransom.

The Brussels Tapestry Company, of Chauncey, N. Y., showed its new self-adjusting car shade. Mr. B. B. Lyons was in charge.

Mr. Oscar L. Whitney, of Cambridge, Mass., showed a model of his car fender which he claims adds a great element of safety to a car.

Noah L. Piper & Son, of Toronto, exhibited a full line of electric and oil headlights and lamps for use in railway work. Mr. Edward S. Piper represented the firm.

The Columbia Fender was exhibited by Mr. J. D. Lamb, Mr. J. E. Chapman and J. J. Durack, all of Montreal. It is automatic in action, and many claims are made for it.

The New York Fare Register & Supplies Company exhibited the Hughes fare register, whose accuracy and reliability are well known. Mr. R. M. Rose was the company's representative.

The Adams & Westlake Company, of Chicago, made an exhibit of several styles of its Acme automatic car shade, which stays where it is left without the use of springs, handles, rachets, cams, pawls or brakes. The exhibit was in charge of Mr. Louis Gray.

Mr. D. L. Winters, of Chicago, showed a handsome model of a truck equipped with his new power brake, which he claims will do as efficient work as an air-brake. After a three months' test it has been adopted for all the cars of the South Chicago City Railway Company.

Mr. P. M. McLaren lost no time in pointing out the merits of the Root boiler, made by the Abendroth & Root Company, of New York, and was able to make some telling arguments by referring to the success which has attended the installation of the boiler in electric power stations.

Mr. E. W. Little, of the Interior Conduit & Insulation Company, of New York, interested the delegates in the new conduit system for feeder cables. The advantages of disposing of cables in this way, according to a plan that has been thoroughly developed and tested by actual experience, are many, and the matter merits the careful consideration of the railway manager.

Adam Cook's Sons, of New York, made an exhibit which showed a variety of packages of the celebrated Albany grease, which has been in use since 1868. It is claimed that this well-known lubricant is the cheapest and safest, and that it is suited for all conditions. Mr. M. N. Peavey represented the company.

The Fitzgerald-Van Dorn Company, of Chicago, exhibited a full-sized aluminum model of its automatic draw-bar, which is designed for use on elevated, cable, and electric railways. The draw-bar couples cars solidly together. It is calculated to stand the severest kind of service. The company was represented by the manager, W. T. Van Dorn.

The Carter Brake Company, of Chicago, exhibited a model of a truck to which was applied the effective brake made by the company. The truck was operated on a miniature track having a steep grade, and the fact that the brake may be depended upon was shown very conclusively. The company was represented by Mr. C. W. Carter and Mr. G. M. Carter.

The Babcock & Wilcox Company, of New York, exhibited portions of their boiler. It was really more instructive to see the parts than the whole assembled apparatus. The forgings for uniting the tubes at their ends were very intricate, but nevertheless strong. They showed a high degree of mechanical skill. Mr. W. T. Bonner, Canada agent for the company, was present.

The Robinson Electric Truck & Supply Company, of Boston, exhibited a model of its truck, showing the action on a curve. The model was neatly built of aluminum, with wooden top sides. To push it along the curve was sufficient evidence of its easy running. The model was of a six-wheel truck. As most street railway men know, the forward and rear wheels swivel, while the middle wheels have a lateral motion. It certainly is correct in principle, and experience has shown it to be smooth in action. Mr. William Robinson represented the company.

The Roll Slipless Car Wheel Company, of Wilkes Barre, Pa., exhibited its slipless wheel, for which many interesting claims are made. It has a series of inclined oblong holes extending through the tread and a circumferential rib extending upwardly between the adjacent ends of the holes, thus forming a narrow, continuous bearing surface. The slots taper to such an extent that they cannot fill up and the wheel therefore does not slip. The company has received from the Wilkes Barre & Wyoming Valley Traction Company a strong endorsement of the slipless wheel. H. F. Phillips, the secretary, represented the company.

The Falk Manufacturing Company, of Milwaukee, Wis., exhibited its famous cast-welded rail joints. There were section of joints showing how close and firm is the union. It is a little mystifying to explain how the rigid joints withstand expansion and contraction. The representatives state that the rails are always in a state of stress, stretching like rubber bands instead of opening at the joints. Under this tremendous strain any poor joint at once gives way, and is early detected and repaired. The inertia of the heavy mass at the joint effectively resists pounding. Mr. E. A. Wurster represented the company.

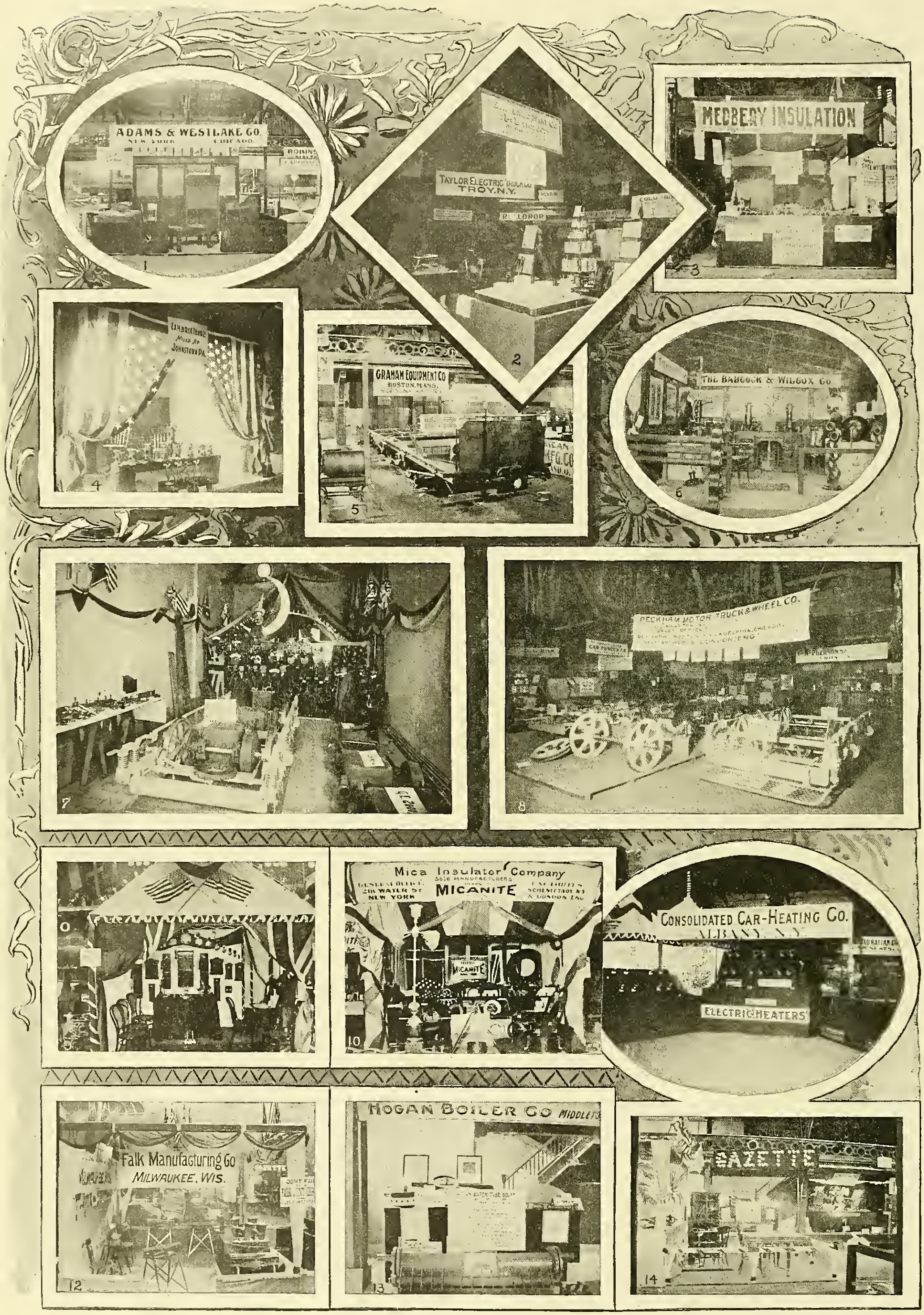
The Walker Manufacturing Company, of Cleveland, O., made its usual interesting exhibit. Two complete equipments and an elaborate switchboard were shown. One of the equipments was exhibited in operation. The commutator lids were open while running, and the commutators operated sparklessly and without heating. That the Walker people have great confidence in the construction of their apparatus was shown in their exhibiting it in process of manufacture. Their armature with its formed coil was very interesting to both the technical men and the practical street railway official. Mr. R. N. Baylis and Charles W. Kent were the experts in charge, while Mr. W. H. Bone, general manager, looked after the other interests of the company. The exhibit was one of the largest at the rink.

The Chapman Valve Company, of Indiana Orchard, Mass., exhibited a line of high-pressure steam valves, suitable for 150 to 200 pounds. Valves from five inches up are provided with by-pass auxiliary valves, to relieve the pressure on the main valve when filling the line. A new valve called the angle gate valve, by means of which one steam fitting is saved, was also shown. A double valve for blowing off was exhibited. By means of this, one tight valve is always to be had, for it is closed and opened under balanced pressures. A line of heavy brass valves, for feed-water connections, amply capable of resisting all ramming incident to feed-water piping, formed an interesting part of the exhibit. Mr. E. L. Ross represented the company, and, knowing the subject well, the good qualities of the valves were at once apparent to any steam user conversing with him. These valves are used in the Montreal power-house and also at McGill University.

The Skeen Electric Switch & Signal Company, of St. Louis, made one of the most interesting exhibits in the rink. The automatic semaphore signal was shown in operation. Its location was assumed for exhibition purposes to be at a crossing of electric tracks. Current was available for the operation of signals which are targets during the day, and green and red lights at nights. The use of a semaphore would reduce the possibility of a collision at a crossing to a minimum. The system also provides a safety switch, which cuts off the power from a second car until the first car has passed the intersection. Should a down grade be located at the intersection and should a motorman allow his car to proceed when the signal is set against him, provision is made for applying the brakes or reversing the motors. An interesting novelty which was also exhibited, was a trolley holder. This is designed to catch the trolley rope automatically, when the wheel leaves the wire, so that the wheel is not allowed to fly upward and damage the overhead work. Mr. Robert Skeen was in charge of the exhibit.

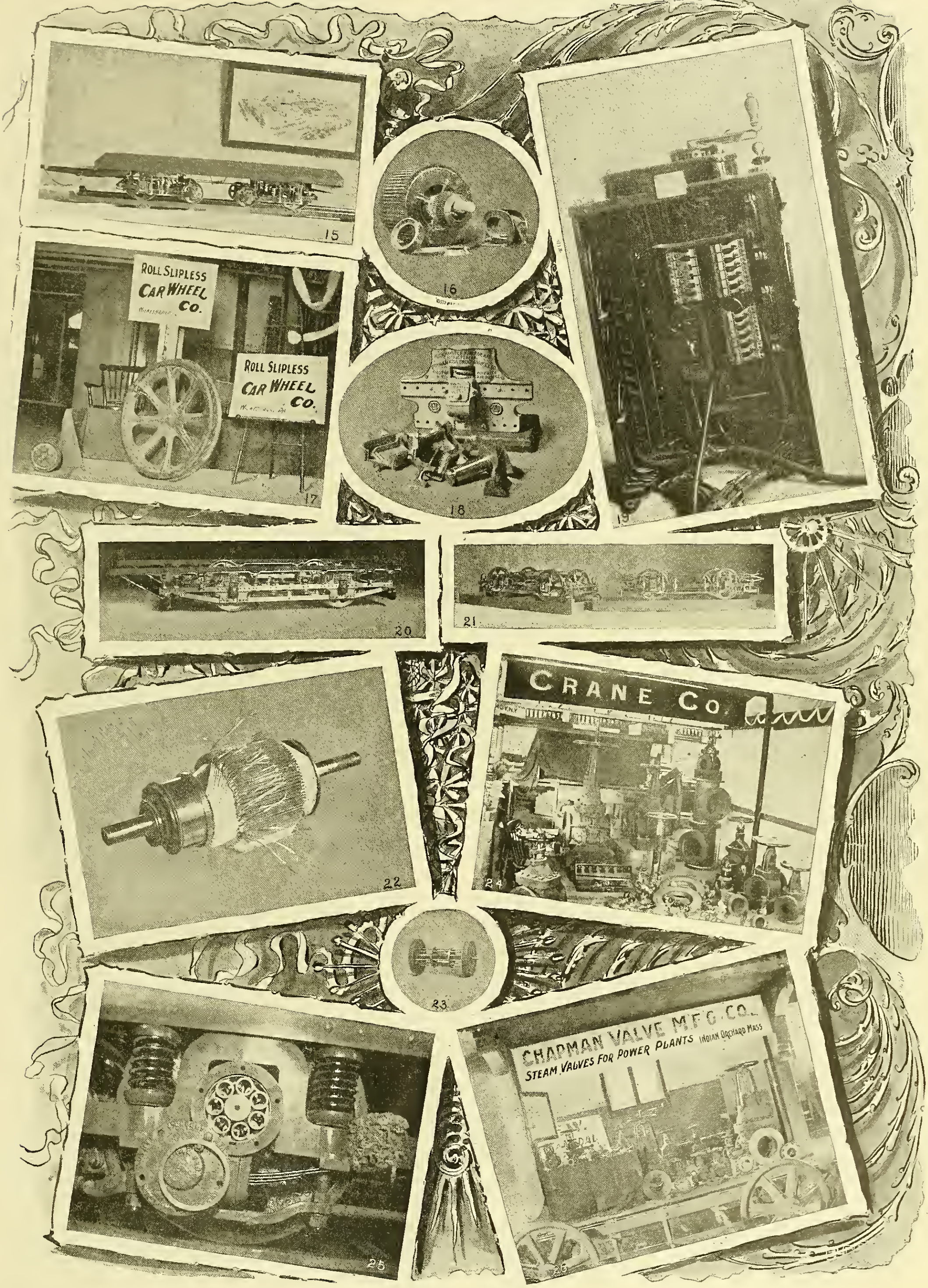
The General Electric Company made an exhibit which, as usual, was one of especial merit, and which attracted a vast amount of attention. The Sperry electric brake, of which the General Electric Company has recently acquired the patents, was shown in operation. It has been greatly improved since its first appearance. The G. E.-800 motor was in operation on the truck in the centre of the hall, and a new controller operating the brake as well as the motors was connected onto the equipment. On the elaborate switchboard were exhibited heavy switches, a heavy current recording wattmeter and a fine display of ammeters and voltmeters. The G. E.-1,200 and 2,000 motors were also shown, and a large locomotive controller was an object of especial interest. The exhibit was made more attractive by two rotating wheels displaying miniature colored lamps, which, by means of cylinder switches, gave a great variety of pleasing combinations. The company was represented by the following gentlemen: Messrs. F. M. Kimball, P. L. Saltonstall, C. C. Pearce, P. Hodges, of Boston; W. B. Potter, L. Dunbar Tandy, A. S. Heywood, of Schenectady; R. H. Beach, A. K. Baylor, W. G. Bushnell, of New York; H. J. Crowley, of Philadelphia; S. W. Trawick, of Atlanta; F. H. Strieby, of Cincinnati; F. C. Todd, of Baltimore; T. H. Fearey, of Buffalo; G. D. Rosenthal, of St. Louis.

The Peckham Motor Truck & Wheel Company, of New York, was unusually successful in arranging an exhibit designed to arrest the attention of the practical railway manager. Two handsomely painted and decorated tracks were shown of the well-known Peckham type. A collection of parts illustrated the details of construction, including the familiar flexible gear and the improved Peckham bearing. On one of the trucks the Peckham emergency brake, by which the shoes are forced against the wheels by a powerful toggle joint device, was shown, and was commented upon as an important adjunct on an electric car. A handsome and accurate model showing the truck in all its details was a feature of interest in the exhibit. With a few unimportant exceptions, all parts of the model are made of aluminum. The Excelsior truck, a recent production of the company, was examined by the delegates as a type well calculated to withstand the hard service on electric roads. Applied to the truck was the effective Wood & Fowler track brake, which is manufactured solely by the Peckham Company. In the construction of the truck spring-cushioned gear is employed, by means of which the track and rail joints are largely saved from the hammer blow that the rigid mass of the truck would otherwise impart to them. The cantilever extensions are very powerfully braced and afford a substantial support to the car body, especially when the roadbed is in such condition that the body is inclined with less adequate supports to rock. A substantial life guard was attached to the truck. The truck is constructed with hot rivets and is machine fitted throughout, and it has been adopted as standard on a member of railways in different parts of the country.



STREET RAILWAY EXHIBITS AT MONTREAL.

1. Adams & Westlake Co. 2. Standard Paint Co. 3. Fiberite Co. 4. Cambria Iron Co. 5. Graham Equipment Co. 6. Babcock & Wilcox Co. and Goubert Manufacturing Co. 7. General Electric Co. 8. Peckham Motor Truck & Wheel Co. 9. C. W. Henderson. 10. Mica Insulator Co. 11. Consolidated Car Heating Co. 12. Falk Manufacturing Co. 13. Hogan Boiler Co. 14. "Gazette" Headquarters.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ROLL SLIPLESS CAR WHEEL CO.
ROLL SLIPLESS CAR WHEEL CO.
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CRANE Co.
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CHAPMAN VALVE M'F'G CO.
STEAM VALVES FOR POWER PLANTS INDIAN ORCHARD MASS
25
26

STREET RAILWAY EXHIBITS AT MONTREAL.

15. Model of Brill Maximum Traction Truck. 16. Micanite Insulation in Unusual Forms. 17. Roll Slipless Car Wheel Co. 18. Peckham Flexible Gear. 19. General Electric Locomotive Controller. 20. Aluminum Model of Peckham Truck. 21. Models of Brill Standard and New Radial Trucks. 22. Construction of Walker Motor Armature. 23. Model of Spring-supported Wheels. 24. Crane Co. 25. Meneely Tubular Bearing. 26. Chapman Valve Co.

Mr. R. Dittricks, of Cleveland, exhibited his new fender which is automatic in action and does not depend on the alertness of the motorman in order to prevent accidents.

The Coleman Fare Box Company, of Tottenham, Ont., exhibited its portable fare box which it is claimed cannot be tampered with by conductors. Mr. J. H. Coleman represented the company.

H. J. Wightman & Co., of Scranton, Pa., called particular attention to their excellent rail bond, which seems bound to increase the conductivity of the return circuit. Mr. H. J. Wightman represented the company.

The Benedict & Burnham Manufacturing Company, of Waterbury, Conn., made an exhibit designed to illustrate the merits of the solid one-piece rail bonds. The bonds were shown in position on a high girder rail. Mr. J. H. Woodward represented the company.

The R. D. Nuttall Company, of Allegheny, Pa., whose goods are known wherever there is an electric railway, was represented by the president, Mr. R. A. Estep, and Mr. Charles J. Mayer, of Philadelphia. They had something to say in reference to trolleys and bearings.

The Crane Company, of Chicago, exhibited a fine line of high-pressure valves, both of the globe and gate pattern. Heavy valves with by-passes, valves with graduated indexes and exceptionally large valves were tastefully arranged in the space. Mr. G. A. Hurd represented the company. Almost all the valves were suitable for a working pressure of 200 pounds.

Mr. D. C. Sweet, Springfield, Mass., exhibited Sweet's bronze sand and salt box, which attracted considerable attention. It is claimed that this box cannot rust or be clogged with wet sand or gravel. It has not a set-screw or nut in its construction. It will deliver a spoonful at a time or a stream, and will work equally well with sprocket chain, hand lever or foot punch.

The Forest City Electric Works, of Cleveland, O., represented by Mr. W. B. Cleveland, of Cleveland, and Mr. John C. Dolph, of New York, made a display of roll drop commutator bars. It is claimed that the process of making these bars by means of a die, and a 400-pound drop hammer turns out a tougher and more compact product than is possible with any other means.

The E. T. Burrowes Company, of Portland, Me., made an exhibit of its car shades, and of material suitable for shades. In one part of its space was a section of an open car equipped with the Burrowes curtains and fixtures. The new curtain which the company are showing is suitable either for open or closed cars. It is designed on a new plan, by which most of the friction is overcome. Mr. H. H. Russell was in charge of the exhibit.

The Tandem Brake Company, of New York, successfully exhibited its brake by equipping one of the cars of the Montreal Street Railway Company. The car passed the Windsor Hotel and had to climb and descend a steep grade on which the operation of this brake could be successfully illustrated. That the operation of the brake was eminently satisfactory was the opinion of the great number of delegates who watched the trials. Mr. Edward B. Wyman, of New York, and Mr. A. W. Dingman, of Toronto, represented the company.

The United States Projectile Company, of Brooklyn, exhibited a full line of hot pressed, steel motor pinions and cold-drawn steel trolley poles. By a patented process, consisting of taking a block of solid steel, heating it, putting it in suitable dies and subjecting it to a pressure of over 1,000,000 pounds, the material is solidified and toughened far beyond what it could be by any other process. Upward of 15,000 of these pinions have been sold since they were introduced, and in all cases buyers have been well pleased. Mr. John Taylor represented the company.

The Canada Switch & Spring Company, of Toronto, made an attractive exhibit. A truck heavily loaded with six tons of rails, which is equal to the heaviest load carried in practice, was the object on which interest centred. So easily did this truck run that a lady had no difficulty in pushing it with one hand. The cause of this easy running was the Meneely tubular bearing. The axle rolls on tubes of steel, which themselves run on a hardened inclosure. The bearing appeared to be strong and substantial and is said to require no oil. Mr. K. W. Blackwell represented the company.

The Fiberite Company, of Mechanicville, N. Y., manufacturers of the Medbery material, had a prominent and most interesting exhibit, which attracted the attention of the delegates. A most complete line of trolley hangers, curve brackets, strain insulators, frogs, crossovers, circuit-breakers, trolley wheels and harps, as well as station switches and waterproof sockets was shown. Mr. Medbery and Mr. Mason were fortunate in being able to call the attention of the delegates to the fact that all of the systems in Montreal were equipped entirely with material manufactured by the Fiberite Company.

The Cutter Electrical & Manufacturing Company, of Philadelphia, was represented by W. E. Harrington, and made a most interesting exhibit of automatic magnetic circuit-breakers, switches, etc. Many words of praise were spoken for the circuit-breaker, and Dr. Cary T. Hutchinson was so well pleased with the result of his investigation that he specified the Cutter automatic magnetic circuit-breaker for the switchboard in the Library of Congress Buildings, to replace combined fuse and switch now in use there. This means the sale of 20 double pole type circuit-breakers of 500 amperes capacity. These circuit-breakers were also in use in the handsome switchboard exhibited by the Walker Manufacturing Company.

The Standard Underground Cable Company, of Pittsburg, exhibited a collection of cable and wire sections taken from cables in actual use. To those familiar with the particular localities where these cables were used the exhibit was one of especial interest. A section of cable deserves much more study than is usually bestowed upon it, for the slightest difference in arrangement may mean hundreds of dollars' difference in price, and success or failure in operation. Therefore, Messrs. G. L. and James R. Wiley were ready to and did impart much valuable information to those visiting these exhibits.

The Hogan Boiler Company, of Middletown, N. Y., made an exhibit which was designed to illustrate the characteristic features of the Hogan boiler. This boiler is especially adapted for unusually high pressures, and the severest tests to which it has been subjected indicate its great efficiency. A complete line of photographs was shown of Hogan boilers in a great variety of power plants. Among other interesting devices which were exhibited were feed-water inductors, manhole plates with copper gaskets, for high pressures, sleeves for extending tubes above the water line, and samples of specially made cold-bent charcoal iron tubes. Mr. J. J. Hogan represented the company, and interested visitors by giving figures of some of the remarkable performances of the boiler.

The Graham Equipment Company, of Boston, exhibited one of its steel framed 20-bench cars. The car complete, ready for the motors, weighs but 3½ tons. Graham's standard I-beam truck, which is so well known, forms the foundation upon which the car is built. As an evidence of the high favor the exhibit attracted, it may be remarked that during the exhibition the car was sold to the Toronto Street Railway Company, of Toronto, Ont. The officers of the company, Mr. James Gunn, superintendent, and Mr. Powers, master mechanic, were sufficiently pleased with the truck to recommend that their company secure the right to manufacture it for the Dominion. Mr. J. H. Graham looked after the interests of the Graham Equipment Company in his usual energetic manner.

The J. G. Brill Company, of Philadelphia, made its exhibit in one of the parlors of the Windsor Hotel. It consisted of handsome and accurate models of three trucks—the well-known maximum traction truck, the old reliable Brill standard, and a new radial truck which the company has recently put upon the market. The Brill Company, as is generally known, has recognized the principle that the nearer the springs can be put to the track, *i. e.*, the place where the blow is struck, the less will be the force of the latter. Hence by putting springs directly on the axle boxes the truck is much easier than formerly to passengers and track alike. The representatives of the Company were Mr. John A. Brill, Mr. Samuel Curwen, Mr. M. E. Curwen and Mr. W. H. Heulings.

The Consolidated Car Fender Company of Providence, R. I., was represented by Mr. J. W. Range, and made a very interesting exhibition of its fender and wheel guard. The operation of this fender is as follows: When a person is in danger of being run over, the motorman touches a bolt head with his foot, dropping the fender so that it runs along the ground on rubber rolls. Should the motorman fail to drop the fender in time and thus allow it to pass over the prostate body, the wheel guard pick-up, similar to the fender, drops automatically by means of a swinging apron as soon as it touches the body. This fender has been in practical use for over eighteen months, and has picked up many men, women and children. In no case did the motorman fail to drop the fender, or was life lost.

The Standard Paint Company, of New York, occupied a large space near the front entrance of the rink, and the varied assortment of samples of the company's goods were arranged effectively and in a way to attract attention. The P. & B. products are now well known wherever good insulating compound is required, and they have a deservedly high reputation among electric railway companies at home and abroad. Samples of P. & B. motor cloth were shown in the exhibit. This material, which is made of strong jute burlap thoroughly saturated with P. & B. compound is regarded with great favor in motor repair shops. Other well-known products made by the company were also exhibited. The two representatives of the company, who are well known in electrical circles, were Mr. Frank S. De Ronde and Mr. J. C. Shainwald.

The Sterling Supply & Manufacturing Company, of New York, occupied a large space in the centre of the rink and its exhibit, arranged with excellent taste and with an eye to effect, attracted a great deal of attention. Mounted on standards the familiar Sterling fare registers, now giving good satisfaction under the test of actual service, could not fail to catch the eye, but attention was also called to them by the continual ringing of the register bells. They were arranged so that they could be operated and the mechanism carefully inspected. The Sterling fender, which is now well known, was also exhibited. This is especially adapted to cars running on city lines and is attached to the truck out of the way of possible damage from collision with other vehicles. The company exhibited its new brake for which many strong claims are made. A large variety of overhead switches and material formed an interesting feature of the exhibit. In point of excellence and in skill in arrangement the entire exhibit was highly creditable. The representatives of the company were Mr. J. H. Carson, Mr. J. J. Kennelly, Mr. George S. Whipp and Mr. George Rumrill.

The Jewell Belting Company, of Hartford, Conn., was represented by Mr. Charles S. Tolles.

The St. Lawrence Machinery Supply Company, of Montreal, exhibited a full line of packings, lubricants and engine-room specialties.

The Davis Car Shade Company, of Portland, Me., made an exhibit of its car shades and fixtures. Mr. E. E. Piper represented the company.

Mr. F. A. Scheffler, the New York representative of the Stirling Company, related some interesting facts relating to the economy of the Stirling boiler.

The Wakefield Rattan Company, of Boston, Mass., made an exhibit of one of its seats for street railway cars, and showed several rattan rail cleaners. Mr. Fred H. Henry represented the company.

The Stever Rail Joint Company, of Cleveland, O., was represented by Mr. L. P. Collins, who explained the merits of the Stever joint. It is claimed that when properly applied this joint requires no further attention.

Mr. T. Lamoreux, of Montreal, exhibited his slot cash collection box detector, which has been applied to the portable fare boxes in Montreal and which it is claimed makes apparent any tampering with the money receptacle.

The H. W. Johns Manufacturing Company was represented by Mr. Henry G. Issertel, of New York, and Mr. E. B. Hatch, of the Johns-Pratt branch of Hartford. They were able to furnish full particulars regarding the use of moulded mica overhead material.

The Meaker Manufacturing Company, of Chicago, exhibited its fare registers, which are well known and have given satisfaction the country over. Mr. J. W. Meaker represented the company and pointed out the merits of the registers when he was able to find any one unfamiliar with them.

The American Electrical Works, of Providence, R. I., was represented by Mr. W. A. Hathaway, Mr. F. E. Donohoe, Mr. John Carroll and Mr. P. C. Ackerman, who fully maintained the excellent reputation already enjoyed by their company. Feed, trolley, magnet and bond wires were introduced to the delegates. The American rail bond is all copper, simple in construction, easily adjusted, and cannot break or jar loose from the effects of heavy traffic.

Mr. J. Lester Woodbridge, of New York, interested the delegates by describing a "booster" system, by utilizing which expensive feeder wires are in many cases made unnecessary. This system was recently installed on the lines of the Chester Traction Company of Chester, Pa., and is giving great satisfaction.

Gleyre Bros., of St. Louis, exhibited the Trendley automatic hand-brake as attached to a model of a truck. It is claimed that in actual service the brake acts as effectively as the air-brake, and at the same time it is simple and durable and not liable to get out of order. The firm was represented by Mr. F. A. Yates, manager of the New York office.

The Pettingell-Andrews Company, of Boston, was represented by Mr. C. B. Price and Mr. Frank X. Cicott. This company carries a full line of electrical supplies, and represents the Billings & Spencer Company, of Hartford, Conn., whose patent drop-forged commutator segments are in use on many of the principal street railways of the country.

The American Rail Joint Company, of Cleveland, O., made an interesting exhibit of the Bartholomew rail joints and Mr. George D. Claflin, Jr., the representative, explained to delegates their peculiar features, which make them so desirable for first-class track construction. The exhibit included rail joints designed for both electric and steam roads.

The Paige Iron Works Company, of Chicago, Ill., had desk room in the rink, and distributed some interesting pamphlets describing and illustrating its special work for street railways. The company makes a specialty of this branch of work, and it has been especially successful in this field. The company's representatives were Mr. Alonzo W. Paige and Mr. E. F. Netherent.

The Lombard Hydraulic Brake Company, of Boston, Mass., exhibited its brake in operation on one of the cars of the Montreal Street Railway Company. The car made a great number of trips, and many street railway men accompanied it and were greatly interested in the brake, which was exceedingly effective in operation. Mr. H. M. Daggett, Jr., represented the company.

Morris, Tasker & Company, of Philadelphia, called attention by widely distributed placards that they manufacture the celebrated S. S. S. joint tubular poles used by electric railway companies in many countries. In the rink engravings of these poles used by the Electric Railway Company, of Bristol, England, were shown. Mr. H. C. Vansant and Mr. Charles Y. Flanders were the firm's representatives.

A. Jackson Reynolds & Co., of Worcester, Mass., exhibited Jackson's electric street cleaner and self-loading car. One car is guranteed to sweep, load, and carry away twenty miles of street dirt or snow a day, and save 65 per cent. of present cost. Horse sweepers sweep from the curb, up near the rails, and the dirt is taken up and out of the city by the self-loading car. The company was represented by Mr. A. Jackson Reynolds.

The Fuel Economizer Company, of Matteawan, had a most satisfactory exhibit, illustrating its system, although it had not been prepared for the occasion. The economizer was located in the power station of the Montreal Street Railway Company. It is claimed that the use of the economizer in this plant effects a saving of 14 per cent. On Thursday the delegates were invited to visit the power station, and particulars were furnished by Mr. A. H. Blackburn, general manager of the Economizer Company, Mr. Stanley Green, the Chicago representative, and Mr. William Downs, the New York representative.

The McGuire Manufacturing Company, of Chicago, was represented by Mr. W. J. Cooke, of Chicago, and J. A. Hanna, of New York. They interested the delegates in the latest improvements in McGuire trucks and plows. The company evidently thought that these well-known parts of a street railway equipment were familiar to the delegates for they were not exhibited. The space which the company occupied in the rink was used for the exhibition of the Columbia car heater. This was shown in its position on a car seat and it was seen that it required little room. This stove has given great satisfaction where it has been used.

The New Haven Car Register Company, of New Haven, Conn., fitted up its booth in a most attractive manner and arranged a number of well-known registers in such a way that they could be operated, inspected and carefully tested by those who were interested. The company received a great many compliments for the excellence of its exhibits, and a great deal of interest was taken in its reliable and ornamental fare register. In connection with this exhibit was shown that of the American Railway Supply Company, which comprised buttons, railway badges, plates for caps, and a number of novelties. The New Haven Car Register Company was represented by J. S. Bradley, F. C. Boyd, Frank A. Morrell and A. N. Loper.

The Ohio Brass Company, Mansfield, O., displayed one of the most tasteful exhibits in the rink. The various devices were arranged on a pyramidal structure in the booth. The sign of the company was displayed in resplendent brass letters above the exhibit. The goods were elegantly finished and presented a very pleasing appearance against a dark background. There were shown the Wood flexible pole bracket, Walker trolley harp and wheel, the King straight under running adjustable switch, the type "K" metal-clad trolley hangers and the universal favorite type "W" cap and cone hangers, about 20,000 of which the Cincinnati Street Railway Company employed on its double-trolley lines and pronounced the most satisfactory ever used or tested. Mr. C. King, Mr. J. F. McCartney, and Mr. Charles Traxler were in charge and looked after the interests of the company.

C. C. Sibley & Co., of New York, represented by Mr. T. M. R. Meikleham, showed an interesting telephone system, which can be very advantageously applied to electric railways. A number of stations can be installed, each involving very simple apparatus and not more than two wires. Nevertheless any one station of the number can be called up at any other station. Therein lie the claims of the company. Such a device could be very advantageously applied to electric railway systems as telephonic communication between not only the central station, but other points on the line would not only be a great convenience, but would often result in the saving of many dollars. The apparatus utilizes trolley current and therefore requires a minimum of attention. The company also represented the Composite Brake Shoe Company, of Boston, and the Eastwood Wire Manufacturing Company.

Mr. George S. Whyte, of Chicago, had charge of the exhibits of the Chicago Insulated Wire Company, of Chicago and Sycamore, Ill., and the Badger Manufacturing Company, of Milwaukee, Wis. The exhibit of the latter company consisted of a complete line of overhead material, Badger fusebox, trolley base, Hoffman rail bond, etc. The Chicago Insulated Wire Company exhibited bare and insulated copper wire, ranging from 500,000 circular mils stranded feeder cables to No. 35 magnet wire. Mr. Whyte distributed attractive paper weights in the shape of Badger trolley bells in miniature. This is an improved form of the W. E. hanger, so designed as to protect the cap holding insulated stud from the weather and securely locking it so that it cannot become loose from the constant jar. Mr. Whyte also distributed small spools of No. 35 magnet wire, and a useful lineman's handbook of facts and figures for electric railway construction.

The Taunton Locomotive Works, of Taunton, Mass., made an exhibit which involved great expense, but which enabled the delegates to gain a good idea of some of its specialties. There were exhibited two massive snow plows, which seemed heavy and powerful enough to cope with the severest of even Montreal's famous snow storms. The plows were withal easily manipulated by powerful and convenient levers and wheels located at each end of the car. Beside the rink exhibit a street sprinkler of 2,700 gallons capacity was shown in actual use upon the streets. This, it was claimed, was sufficient to thoroughly sprinkle at least four miles of track, the spread being 20 feet. The throw of water can readily be controlled, both in direction and intensity, by convenient levers. Two of these sprinklers are in actual, practical use, one at Bridgeport, Conn., on the lines of the Bridgeport Traction Company, and the other is operated on the Nassau road of Brooklyn, N. Y. The company's representatives were Mr. W. R. Billings, of Taunton, and Mr. Jacob Wendell and Mr. R. L. McDuffie, of New York.

Habirshaw Insulation was represented by Messrs. J. W. Godfrey and F. W. Harrington, who distributed as a souvenir a very handsome memorandum book.

Darling Bros., of Montreal, exhibited the Warren Webster steam economizer, for which they are agents for Canada. A number of specialties which the firm handles were also exhibited.

The Goubert Manufacturing Company, of New York, exhibited models of the Goubert feed-water heater and the Stratton separator. Both of these pieces of apparatus have acquired a reputation as standard. No economical steam plant does without such devices, and many hundreds use these particular makes.

The Partridge Carbon Company was represented by Mr. J. S. Speer, secretary, and exhibited Partridge self-lubricating motor dynamo and generator brushes, and also distributed a very handsome catalogue giving full information regarding sizes of brushes required for different types of machines.

The Union Grease Company, Boston, Mass., made an exhibition of ornamental packages of car axle, machinery, marine covering, electric motor, amba and other greases. Its sign read: "500 Miles with 50 Lbs. of Union Grease," "Not Poetical but Practical," "No Hot Boxes with Union Grease," "Established in 1879," etc. This company was represented by Messrs. C. M. Fuller and Oliver Downing.

The Okonite Company, of New York, carried a new idea in tape to the convention which caused much favorable comment. The novelty consists of a new form in which the company is putting out the celebrated Manson tape, and was shown by Capt. Willard L. Candee. The usual manner of supplying the trade with tape has been for the manufacturers to put it up in half pound packages or rolls, encased in tin-foil or other wrapping. It is the experience of most companies that a lineman in using tape so put up, after taking what is needed for the work in hand from the reel, will throw away what was left, or if the remnant was back in the kit, the wrapping would soon become loose, the tape gather dust and dirt and in a short time become almost unfit for further use. Capt. Candee showed the Manson tape packed in round tin boxes of two colors—red and white—both very attractive and neat in appearance, and containing one ounce of the tape. This, nine times out of ten, would be a sufficient quantity for any ordinary repair, and if there be any left over it may be put back into the box, which is conveniently small (about the size of a silver dollar), where it will be kept fresh and clean and ready for use at any time.

The Whittingham Car Heating Company, of Baltimore, gave a practical demonstration of the merits of its system of electric heating. Two benches representing seats in a car were arranged in the space, and in the proper position the heating pipes were placed. The benches were found to be exceedingly comfortable resting points, and the company ought not to have found any fault with the temperature of the rink, for it caused visitors to linger about the exhibit. The electric heating system is a radical departure and is worthy of investigation. Mr. J. Paul Baker represented the company.

Theophile Euphrat, Darien, Conn., exhibited his combination housing harp and trolley wheel, with automatic lubrication. The fork consists of a socket to attach it to the upper end of the pole, having a jaw to carry the wheel for guiding the conducting wires into the groove, the whole being properly constructed to conduct the electric current into the fork, to be transmitted to the conductor in the pole. The combination also included an ice and sleet cutter wheel, which can be instantaneously adjusted, and which is also lubricated. Mr. Euphrat's exhibition of trolley wheels was very favorably spoken of by all railway men present.

The Charles Scott Spring Company, of Philadelphia, fitted up its booth in characteristic fashion. The potted plants and palms which are features of their exhibits were in place as usual, and the good taste in the use of flags and bunting was again displayed. The material which the company showed was arranged in such a way that it presented an attractive appearance. The company showed a great variety of springs for street railway and electrical purposes. It manufactures coiled and elliptical springs suitable for every truck which is manufactured. The company's representatives were Mr. Wm. H. Hansell, Mr. Harry C. Johnston and Mr. Charles Scott, Jr.

The H. B. Camp Company, of Aultman, Ohio, was represented by Mr. A. L. Daniels, who made an exhibit of vitrefied clay conduit which attracted considerable attention. This conduit is manufactured from the best clay, well glazed, and, it is claimed, will last for centuries. It has been used for several years by the Chicago Telephone Company, Chicago; the Bell Telephone Company, Buffalo; People's Traction Company, Philadelphia; Public Lighting Commission, Detroit, and by many other large companies. Mr. Daniels claims that investigation almost invariably results in the adoption of the conduit, and that where once used it has never been superceded by anything else.

The New York Car Wheel Company, of Buffalo, N. Y., made a joint exhibit with the St. Thomas Car Wheel Company, of St. Thomas, and the Montreal Car Wheel Company, of Montreal. A large number of machined motor car and trailer wheels, and axles of various sizes and weights were exhibited. The exhibit was arranged with great care and made an exceedingly fine showing. The New York Car Wheel Company was represented by Mr. P. H. Griffin, Mr. T. Guilford Smith and Mr. Robert J. Mercur; the St. Thomas Company by Mr. A. E. Domville, and the St. Thomas Company by Mr. T. J. Drummond. In the same space was shown an exhibit of different iron ores made by the Canada Iron Furnace Company of Montreal.

The Attendance.

The following is a list of the delegates and visitors at the Convention:

LADIES.

Barnes, Mrs. C. E.
Beach, Mrs. R. H.
Bennett, Mrs. J. B.
Breed, Mrs E. S.
Bristol, Mrs. H. A.
Brown, Mrs. R. S.
Candee, Mrs. Willard L.
Chambers, Mrs. George
Chapman, Mrs. W. D.
Childs, Mrs. Arthur E.
Connette, Mrs. E. G.
Cunningham, Mrs. J. H.
Curley, Mrs. Thomas P.
Daggett, Mrs. H. M., Jr.
Dimmock, Mrs. W. S.
Dodge, Mrs. G. A. W.
Eldredge, Mrs F.
Farwell, Mrs. H. C.
Green, Mrs Frank A.
Harrison, Mrs. Russell B.
Hogan, Mrs. John J.
Johnson, Mrs. G. J
Johnston, Mrs. W. J.
Kelly, Mrs. W. J.
Kimball, Mrs. F. M.
Lodge, Mrs. George
Lodge, Miss Mabel
McAdoo, Mrs. M. R.
Medbery, Mrs. H. J.
Medbery, Miss
Mulhern, Mrs. George C.
Price, Mrs. C. B.
Price, Mrs. Chas. W.
Richardson, Mrs. C. A.
Richardson, Miss Mabel
Robinson, Mrs. J. C.
Scheffler, Mrs. Fred. A.
Shaw, Mrs. Jos. F.
Silliman, Mrs. Frank
Simmons. Mrs. E. A.
Sylvester, Mrs. S. E.
Thompson, Mrs. A. C.
Thompson, Miss Birdie
Wattles, Mrs. J. F.
Wightman, Mrs. Geo. H.
Young, Mrs. A. M.

AKRON, O.

Daniels, A. L.
Chapman, W. D.

ALBANY, N. Y.

McElroy, J. F.
Ransom, H. N.

ATLANTA, GA.

Hurt, Joel
Trawick, S. W.

BALTIMORE, MD.

Baker, J. Paul
Thompson, Samuel B.
Todd, F. C.

BOSTON, MASS.

Beard, W. W.
Benedict, W. G.
Brown, R. S.
Baumgartner, S.
Cicott, F. X.
Clark, Charles S.
Condit, Sears B.
Cunningham, J. H.
Estes, S. C.
Field, A. W.
Gorham, Richard H.
Graham, J H.
Hoadley, George M.
Hilton, G. A.
Kimball, F. M.
Lombard, N.
Morse, C. B.
Pierce, C. C.
Price, C. B.
Pringle, R. E. T.
Record, E. A.
Robinson, J. C.
Robinson, William
Saltonstall, P. L.
Sergeant, C. S.
Shaw, Jos. F.
Sylvester, S. E.
Townley, C.
Wattles, James F.
Wightman, George H.
Wood, Charles N.

BRIOGEPORT, CONN.

Heft, N. H.
Parrott, F. W.
Radel, Andrew
Setzer, Henry

BROCKTON, MASS.

Morse, John P.
Rogers, Horace B.

BROOKLYN, N. Y.

Cannon, Duncan B.
Crossman, T. E.
Edwards, A.
Littell, H. M.
Morrison, Wm. M.
Porter, Charles E.
Schieren, Charles A., Jr.
Wood, V. C.

BUFFALO, N. Y.

Burnett, J. A.
Danforth, R. E.
Fearey, T. H.
Griffin, P. H.
Mercur, Robert J.
Rusling, F. O.
Sharp, Edward P.
Smith, T. Guilford
Watson, H. M.

CAMDEN, N. J.

Browning, G. G.
Curley, Thos. P.
Fenner, Samuel W.
Harrington, Walter E.
Rowland, Lewis G.
Morgan, J. Willard

CHICAGO, ILL.

Atkinson, J. M.
Bailey, Geo. C.
Bennett, John B.
Boyer, F. N.
Boyd, James.
Brydges, F. C. T.
Carter, Clarence W.
Carter, G. M.
Collins, W. F.
Cooke, W. J.
Cosper, W. P.
Davies, Wm. N.
Dean, D. B.
Deland, Fred.
Donohoe, C. E.
Du Bois, E. D.
Englund, A. H.
Fuller, F. L.,
Gray, Louis
Green, Stanley
Greene, Frank R.
Hamilton, D. G.
Harrison, H. H.
Henry, George W.
Hill, R. J
Holt, Pliny G.
Hurd, G A.
Jones, B. J.
Jones, F. B.
Kenfield. Fred S.
Kenfield, H. J.
Keeran, N. C.
Knickerbocker, C. K.
Leach. P. F.
Littlefield, A. S.
Mason, W. R.
Meaker, J. W.
Millar, J.
Nethercut, E. F.
Newbert, W. F.
Noble, E. J.
Noe, Charles C.
Paige, Alonzo W.
Penington, T. C.
Randall, F. C.
Seeber, C. J.
Shainwald, J. C.
Stewart, F. S.
Tebbits, J. S.
Van Dorn, W. T.
Wellington, A. G.
Whitmore, Charles E.
Whyte, George S.
Wiley, James R.
Windsor, H. H.
Winter, D. L.
Wise, Clift.

CINCINNATI, O.

Bradford, H. P.
Lilley, L. G.
Strieby, F. H.

CLEVELAND, O.

Barr, B. M.
Baylis, R N.
Billings, Frank
Bone, W. H.
Claflin, Geo. D., Jr.
Cleveland, W. B.
Collins, L. P.
Dittricks, R.
Dutton, W. A.
Henry, George W.
Kent, Charles W.
Mulhern, George C.
Sperry, Elmer A.
Starr, D. A.

DANBURY, CONN.

Holley, S. C.
Wardwell, Fred. S.

DARIEN, CONN.

Euphrat, Theo.
Perry, Chas. C.

DAYTON, O.

Bimm, E.
Routzahn, Nelson
Voss, William

DENVER, COL.

Wood, H. Holton
Porter, D. U.

DES MOINES, IOWA.

Hippee, Geo. B.
Owens, W. G.
Park, H. H.

DETROIT, MICH.

Goodman, N. W.
Liggett, John C.
Swift, Chas. M.

FITCHBURG, MASS.

Preble, Geo. H. R.
Wallis, Robert N.

GLOUCESTER, N. J.

Royal, Horace M.
West, Henry J.
Thompson, Wm. J., Jr.
Ferguson, Willard B.
Thompson, Wm. J.

GRAND RAPIDS, MICH.

Amoble, N. W.
Johnson, G. J.

HAMILTON, ONT.

Charlton, B. E.
Paterson, John.

HARTFORD, CONN.

Grauten, Wm.
Luscomb, H. H.
Goodrich, E. S.
Tolles, C. L.
Hatch, E. B.

HAZELTON, PA.

Markle, Alvin
Thompson, George

Joliet, Ill.

Hulsizer, J.
McDowell, George

Kansas City, Kan.

Holmes, C. F.
Satterlee, Wm. A.

Kingston, N. Y.

Kaufman, C. C.
Wilkinson, W. H.

Lancaster, Pa.

Armstrong, Wm. A., Jr.
Tremper, W. J.

Lawrence, Mass.

Clark, Chas. S.
Richardson, Chas. A.

Louisville, Ky.

Haddox, J. O.
Minary, T. J.

Manchester, N. H.

Gallinger, J. H.
Williams, Charles.
Williams, J. H.
Walker, N. H.

Mansfield, O.

Haycox, W. E.
King, C. K.

Milwaukee, Wis.

Hoffman, A.
Wurster, E. A.
Wyman, C. D.

Montreal, Que.

Bellingham, W.
Biggar, E. B.
Blackwell, K. W.
Bonner, Wm. T.
Bovey, H. T.
Bulmer, J. E.
Carroll, John
Cass, J. H.
Chapman, J. E.
Corriveau, A. J.
Cunningbam, G. C.
Dean, W. F.
Durack, J. J.
Forget, L. J.,
Green, Frank J.
Henderson, C. W.
Hewitt, E. A.
Hill, J. F.
Hinphy, W. J.
Hunt, Geo.
Jackson, Stonewall
Julien, E. D.
Kemper, J. M. de Bosch
Kilpin, George J.
Lamb, J. D.
Lamoreux, T.
Leyden, H. R.
Lusher, E.
Macpherson, Alex.
MacDonald, A. Roy
McDonald, Duncan A.
McDonnell, Alex.
Ross, James,
Roy James R.
Smith, George D.

Nashville, Tenn.

Connette, E. G.
Jackson, W. H.

New Bedford, Mass.

Gardiner, A. C.
Handell, C. F.
Potter, E. E.

Newburyport, Mass.

Clark, William P.
Shaw, J. F.
Eldredge, H. F.
Shaw, Warren.
Odell, Charles.

New Brighton, N. Y.

Gaazlead, A. M.
Sheif, W. N.

New Haven, Conn.

Boyd, F. C.
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Morrell, Frank A.
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Hanna, J. A.
Harding, H. McL.
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Harrison, H H.
Haskell, G. M.
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ELECTRIC RAILWAY GAZETTE

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CORRESPONDENCE IS INVITED upon all subjects of interest to those engaged in practical electric railway work. Prompt and full information regarding CHANGES OF OFFICERS, NEW EQUIPMENT, EXTENSIONS, etc., will be greatly appreciated. Communications intended for a particular issue should reach this office not later than the Thursday morning of that week.

AS THE ONLY PUBLICATION in the world DEVOTED TO THE ELECTRIC RAILWAY INDUSTRY, and the only journal adequately treating THE NUMEROUS TECHNICAL FEATURES INVOLVED IN ITS MODERN DEVELOPMENT AND PRACTICE, the ELECTRIC RAILWAY GAZETTE aims worthily to represent the activity and progressiveness of the important interests to which it is devoted. Presenting ALL THE NEWS EVERY WEEK, and describing CURRENT IMPROVEMENTS AND DEVELOPMENTS immediately upon being brought forward, its pages offer to those engaged in the electric railway field the TIMELY ADVANTAGES ENJOYED IN OTHER ACTIVE AND IMPORTANT BRANCHES OF MODERN INDUSTRY, and to advertisers A LIVE AND ENERGETIC MEDIUM commensurate with their needs and one giving CLOSEST ACCESS TO THE COMMERCIAL OPPORTUNITIES OF AN EXTENSIVE AND GROWING BUSINESS.

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THE NEXT CONVENTION.

The American Street Railway Association made no mistake in selecting St. Louis as the place in which to hold its next convention. No city in the country offers greater attractions to the street railway manager. Its local transportation system has few equals in the country; indeed, the residents of the city insist that it is superior to any street railway system in the world in respect to the general arrangement of the routes, equipment and methods of operation. Certainly it is true that when a manager starts out on a tour of investigation St. Louis is sure to be one of the first cities visited. He is certain of finding there the latest developments in the street railway field. The enterprising railway men of St. Louis appear to be less conservative in many respects than their brethren in other cities. Certainly it seems to be the fact that a new idea, which promises well, receives greater encouragement there than elsewhere. A great proportion of the thousand and one of the little things which have been found of value in all departments of an electric railway company has originated in St. Louis. That the Association will receive a hearty welcome from the St. Louis companies goes without saying. St. Louis hospitality is proverbial, and the most prominent street railway men of the city take the deepest interest in the organization. They gave abundant evidence of this fact at Montreal by subscribing about one fifth of the amount necessary to liquidate the debt of the Association. St. Louis has few superiors as a convention city; its location is central; it has an abundance of excellent hotels, and no difficulty will be found in finding a suitable hall for exhibition purposes. October in St. Louis is the most delightful month of the year, and, taking everything into consideration, it may be assumed that the next meeting will be a memorable one.

A COMPARISON OF TWO CONVENTION REPORT NUMBERS.

A year ago the GAZETTE devoted two different issues to its report of the Street Railway Convention.

This year the report is all given in one number.

The following instructive table shows the quantity of reading matter and also the volume of advertising in the Convention report issues of the GAZETTE on the occasion of the Atlanta Convention, in 1894, and the Montreal Convention, in 1895, respectively:

	READING MATTER.		ADVERTISING.		
Date.	Pages.	Illus.	Pages.	Number of Advt.	Column Inches.
Oct. 24, 1894	12	13	14	50	658
Oct. 27, 1894	12	10	12	45	561
Average of these two	12	11½	13	47½	609½
Oct. 19, 1895	32	18	20	61	842½
Increase	166 p.c.	65 p.c.	54 p.c.	28 p.c.	38 p.c.

It is the earnest hope of the GAZETTE that when the next milestone shall have been reached, a year hence—the St. Louis Convention—the present showing, gratifying as it is, may be eclipsed by the record then made.

The GAZETTE will do its best to bring this about.

IMPROVEMENTS IN STREET RAILWAY APPARATUS.

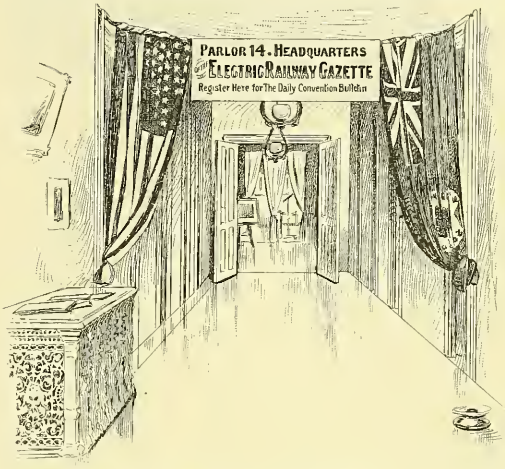
Those who are associated with electric railway interests may congratulate themselves on the progress that has been achieved in the development of apparatus, as indicated by the exhibits at the Montreal Convention. There are several crying evils against which street railway management has been struggling for the last eight years, and it is not too much to hope that some of the new devices shown at Montreal will prove the means of overcoming many of these obstructions to progress. The problem of an efficient brake seems to have been thoroughly studied. The electric brake has been greatly improved, and the exhibit of semi-automatic hand brakes in actual use on the roads of Montreal was very encouraging. The results of efforts to solve the electrolytic problem were shown in exhibits of efficient rail bonds and welded rail joints. An ample track return will certainly go far toward eliminating this vicious trouble. Improved overhead material gave promise of more securely fastened and better insulated wires. Distinct advances in car-building were demonstrated by the display of light and easy-running trucks. The question of fenders was met with a large number of devices, and the practical tests of some of these were certainly encouraging. Precautions against the slipping and skidding of wheels were in evidence in the shape of special wheels and efficient sand boxes. Different forms of insulating material were exhibited which are of great help to the designer as well as the repairer. The street railway official was given excellent opportunities for the exercise of his own judgment in the many car equipments which were shown in actual operation. The construction of the vital parts of motors and generators has been greatly improved. Interchangeable, independent coils for both armature and field magnet have come into general use, and buyers are beginning to appreciate the great convenience which they afford. Commutators formed under great pressure are now offered by manufacturers and prove a valuable feature in the every-day operation of railway apparatus. High-pressure steam valves capable of standing from 150 to 200 pounds pressure were shown, and interested parties were directed to places where they were in actual use under such pressures; improved forms of boilers and heaters were shown, and new and untried devices made their first bow, showing undiminished energy and ambition on the part of inventors generally. Taken as a whole, the exhibits were a splendid success, and it is to be hoped that some of the perplexing problems will, as a result of this Convention, disappear. The exhibits were perhaps more numerous than were ever seen at a convention. Manufacturers evidently are willing to go to great expense and trouble to avail themselves of the opportunity of showing their products to those most interested in them. The exhibition is certainly one of the most interesting features of the annual meetings, and it is a department which should be encouraged by the Association.

The "Gazette" at the Street Railway Convention.

The reception accorded the Electric Railway Gazette at Montreal showed the esteem in which the paper is held by all classes of railway men. Its Convention headquarters were conveniently located on the main floor of the Windsor Hotel, and few, indeed, were the delegates or visitors who did not call and register their names.

Two of the rooms occupied by the Gazette were immediately opposite, and from one to the other of these across the corridor ran a neat and appropriate sign, with a large American and an equally large English flag on each side arranged in the form of a portiere.

The paper also had a space in the exhibition hall in Victoria Rink. The sign used over the exhibit consisted of but one word, "Gazette," in incandescent lamps, which when lighted at night gave a brilliant effect.


PARLOR 14. HEADQUARTERS
OF ELECTRIC RAILWAY GAZETTE
Register Here for The Daily Convention Bulletin

The Gazette was represented at the Convention by five of its New York staff.

There can be no doubt that the paper created a most favorable impression at Montreal, and from conversations with the delegates that its position in the affections of street railways managers is well settled. In fact, without a single exception, every blue-button delegate spoken to on the subject said he was a constant weekly reader of the Gazette, and did not know how he would be able now to get along without it in the management of his road.

The many kind things said of the paper, not only by street railway managers, but also by manufacturers and their representatives at the Convention, will wonderfully encourage those connected with the Gazette to still greater efforts to deserve the good opinions and well wishes so generously expressed in its behalf.

What They All Say.

To the Editor of the Electric Railway Gazette:

Dear Sir:—I am in receipt of your Electric Railway Convention Bulletin, which I consider a great stroke of enterprise. You are to be commended for your hustling ability. I think that the Electric Railway Gazette is fast establishing itself as one of the foremost factors in the street railway journalistic field. Yours truly,

J. P. E. Clark,
General Manager Binghamton Railway Company,
Binghamton, N. Y., Oct. 21, 1895.

An Important Damage Suit Decision.

An important and interesting street railway case before the New Jersey Supreme Court, at Trenton, was decided on Oct. 14. As the case furnishes a precedent, we shall give a somewhat full account of it.

The question was as to the liability of the railway company for the result of an accident caused by the improper bonding of its rails. The suit was brought by Samuel M. Bennett and Charles S. Cooper, plaintiffs, against the Trenton Passenger Railway Company, Consolidated, defendants. In opening the case, counsel for the plaintiffs stated briefly the facts which would be proved. On the 27th of May, 1894, Mr. Cooper, in company with Mr. Bennett, was driving a valuable horse across the tracks of the railway company at the corner of Broad and Market Streets. He was about to take his wife out for a drive, but seeing a long line of cars standing on the street in front of his house, he decided to turn around and go back up Market Street. While engaged in turning, and just as the horse had his hind foot on the rail and his fore feet out on the ground, he received a shock which caused him to become unmanageable. Both men were thrown out and Mr. Bennett was severely injured. He was confined to his bed for two months, and has never fully recovered. The plaintiffs claim that the company is liable because it was negligent in not properly bonding its rails.

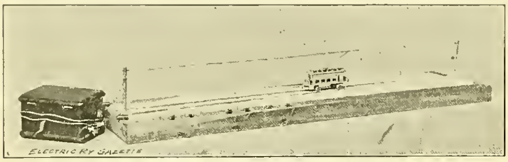


FIG. 1.—MODEL OF ELECTRIC RAILWAY.

The first witness called was a surveyor who testified that he had made the map used in the case to show the location of the road at the corner of Broad and Market Streets. The next witness was a photographer, who was called to identify pictures of a rail joint, showing the manner of bonding. The superintendent of the road then stated that ten or eleven cars were being operated on the Broad Street line at the time of the accident.

Mr. Bennett was called upon to relate the story of the accident. Mr. Cooper testified that the horse, although high spirited, was of a kind and tractable disposition, but since the accident has become so vicious as to be practically useless.

Physicians testified as to the permanency of Mr. Bennett's injuries and veterinarians swore that the horse was suffering from shock, and that its condition was such as might result from receiving a current of electricity.

William Elmer, Jr., was then called as an electrical expert. He exhibited a model of an electric railway and explained to the jury how electricity is applied to a street railway for the propulsion of cars, and how the current, after passing through the motors, returns to the power station through the rails. The usual method of connecting the ends of the rails at the joints, by means of copper bond wires, was also fully explained.

Mr. Elmer then testified that he had examined the system of bonding employed by the defendant company, by taking up the paving stones between the tracks at the corner of Broad and Market Streets, and found that the rails were connected together by a single No. 2 iron wire. There were also supplementary bonds of No. 4 iron wire. The splice was wrapped with wire, and poured with solder. In answer to questions, witness stated that the carrying capacity of a No. 2 iron wire was about the same as a No. 9 gauge copper wire, and that he had never heard of a case where copper wire so small as No. 9 gauge was employed for connecting the rails. He also stated that No. 0000 copper wire was usually employed for bonding the rails, and that if the company desired to use iron instead of copper, in order to obtain the same conductivity as the No. 0000 copper wire would have afforded, the iron bond should be nearly an inch and a quarter in diameter.

The model was then taken up and explained to the jury. It was built, not so much to exhibit the operation of an electric road, as to show this fact, that with a well-bonded road not enough current could escape to injure a horse, and that if the road was badly bonded sufficient current to shock could escape. In the model good rail bonds were represented by U-shaped pieces of copper wire which dipped into small glass tubes containing mercury. The mercury communicated with the ends of adjoining rails, so that when the bond was in place the current could flow from the rail through the mercury and copper wire to the other rail and so on back to the generator in the power station. The generator in the model consisted of a magneto, and when all the bonds were in place and the car on the track the magneto rang loudly, being, of course, on a short circuit. The representation of bad bonds was effected by leading out to the edge of the board two wires from the ends of adjoining rails and passing them through corks into a glass tube filled with water.

By moving the wires up to or away from each other in the water, a point could be found where the bell would ring sufficiently loud to show that there were no open circuits, that is, that the road was still in operation, and yet there was a considerable difference of potential from rail to rail. From the last rail which was connected directly to the dynamo, a stream of sulphate of copper solution was poured, extending alongside the other rails, about three inches from them. The model was then allowed to dry. When a juryman placed two fingers of, say, his right hand, on the rail, and the other two fingers out on the sand, at the side of the track, he could feel no shock. When, however, the model was sprinkled with water, the sulphate solution became a good conductor, and he received a very perceptible shock. The accident occurred in the month of May, when the ground was still moist from the Spring thaws, and in addition it had been thoroughly soaked by a week's rain. A block of cars had occurred on the road, and several cars were starting at the same moment, just below where the accident occurred, so that the return to the power station had to pass that point. The expert's testimony was to show that with several cars starting at the same time, and using an excessive amount of current, there would be a proportionate increase in the leakage from the rails.

Measurements made in May, 1895, for difference of potential between rail and ground four feet away showed under the normal operation of the road, at times, one and one half volts. The inference was that, with the conditions as they were at the time the horse was shocked, there could have been a difference of potential sufficient to cause the accident. Experiments made on horses showed that they jumped at 4.5 volts, direct current.

The cross-examination of this witness was very severe, the principal efforts of the defense being directed to break down the "increase of potential" theory, and the point was made that as the fusing current of No. 2 iron wire is about 350 amperes, and for No. 4 iron wire about 300 amperes, the total carrying capacity of the track system on its four rails was 2,600 amperes.

As the carrying capacity of the trolley wire is about 1,000 amperes, they desired to show that they had a large margin of safety. The witness evidently did not make his reasons for denying this sufficiently clear in his reply to questions, for at the close of his cross-examination the court asked him several questions for further enlightenment. Both questions and answers are so clear, and they seem to sum up so briefly the whole case, that we give them in full.

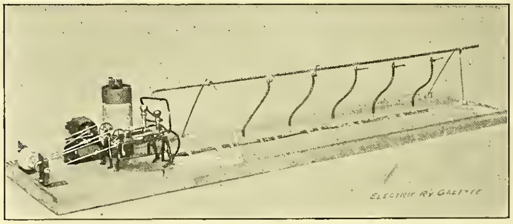


FIG. 2.—WATER ANALOGY OF ELECTRIC RAILWAY.

By the Court:

Q. In constructing an electric road, does the character of the bonding have any relation to the amount of current to be carried? A. Yes, sir.

Q. Necessarily so? A. Yes, sir.

Q. The amount of the current, as I understand it, depends very largely upon the number of cars to be operated on the road? A. Yes, sir.

Q. In other words, a line that runs fifty cars would require a much larger current than a line that runs ten cars? A. Yes, sir.

Q. In constructing a road which was to be operated with some 10 or 12 cars, would the proper bonding of the road be different from that which would be used in constructing a road which was intended to operate 50 cars? A. Yes, sir; it would be different.

Q. In making your bonding do you have regard to the carrying capacity of the trolley wires which take the current out from the power house to the cars? A. No, sir, the trolley wires are of a fixed size.

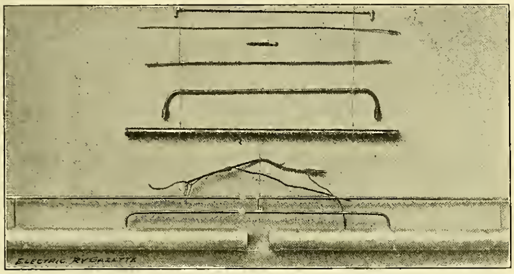


Fig. 3.—EXHIBITS OF BONDING METHODS.

1. Style of Bond Used. 2. The Same Reduced to Copper. 3. A Lead Pencil. 4. Size No. 2 B. W. G. Iron. 5. Proper Size of Copper. 6 Equivalent of Copper in Iron. 7. Piece of Iron Bonding. 8, 9, 10. Pipe Illustration of Rail Bond and Supplementary Wire.

Q. Is it necessary to have your bonding wires of sufficient size to do anything more than to carry back to the power house the current that is carried on the trolley wire? A. Yes, sir.

Q. Why? A. On account of the rise of pressure which would exist between one point of the road and the power house, if the bonding is not sufficient to carry the current back without drop.

Q. Perhaps my question is not plain; I don't understand the answer. I mean this: If you have a trolley wire which carries a current of 500 amperes, that is all the current there is to go back to the power house? A. No, sir, the trolley wire may be fed at different points along the street.

Q. I am assuming that is all the power that it gets. A. Yes, sir, then 500 amperes has to be returned.

Q. Then if it takes 30 amperes to operate a car, that would operate something like 15 cars. Now, if you have a total current sent out from the power-house, either directly over the trolley wire, or on the feed wire, to operate a certain number of cars, as 500 amperes, is it necessary to have the bonding apparatus so constructed as to carry back to the power-house more than 500 amperes? A. It is not necessary to have it constructed more than sufficient to carry properly 500 amperes.

Q. That is what I mean. Now this road has two trolley wires, as I understand it? A. Yes, sir; one over each track.

Q. And you say the carrying capacity of each of these trolley wires, the maximum carrying capacity, is 1,000 amperes approximately? A. Perhaps at white heat.

Q. I say, its maximum carrying capacity. And that the carrying capacity of the tracks with the supplementary wires is 2,600 amperes; is that correct? A. I don't consider that a fair deduction, because the temperature at which these bond wires will get when they are loaded to 2,600 amperes, would make their resistance so high that it would require thousands of volts to force the current through that length of rail and bonding; so that you could not by any possibility send 2,600 amperes through the rails of this system bonded as it is.

Q. Could you send 2,000 amperes through the trolley wires? A. You could if you put pressure enough on it, but with the 500 volts they have here they could not.

Q. Then if that is so, is not a track system such as this sufficient to carry the number of amperes that is used for this particular road? A. No, sir.

Q. Why? A. Because the bond wires are so small that their resistance is sufficient to cause a difference of potential between the rail and the ground at the points mentioned.

Q. I understand you to say that with 10 or 13 cars, as this road has, it only requires something like 350 amperes, and that there is a conductor supplied to return that current capable of carrying 2,600? A. Yes, sir; but that does not take into consideration the pressure required to force 2,600 amperes through, nor the pressure required to force 390 amperes through. If the resistance is a fixed quantity the pressure required to force any given current through is directly proportionate to the current. That is only naming one side of the question. You may have a water pipe to carry so many gallons per minute, but if you want to get more through, you must increase the pressure, as, for instance, the nozzle of a fire hose; and that, we say, is a dangerous increase when applied to the bonding wire. The pipe is not definite as to carrying capacity, because you don't say how many pounds pressure is forcing the water through.

On further direct examination Mr. Elmer produced another model, illustrating the water analogy of an electric railway. Miniature pumps, driven by an electric motor, represented the dynamos, and they forced water into a long pipe representing the trolley wire. Valves on this pipe represented the controllers on the cars, and short pipes of rubber hose returned the current to the rails, represented by short pieces of pipe, held by clips on the bottom of a long, shallow tray, draining to a pit at one end, from which the pumps took up the water again. The poor bonds were represented in this case by the bad joints in the pipes, the ends being simply tapered and entered into each other. This model was also to prove the increased leakage theory. The ground return was partially choked at its outlet, so that when one car was running, that is, when one valve was open, the leakage was very slight, but when two or three cars were using current more escaped, and ran back outside the pipe to the pit, just as current would escape from the rail system into the ground.

Other witnesses testified as to the general abandonment of iron bonding, particularly such small sizes as No. 2.

It was also proved that in a new track the company put down recently the bonding was of triple lace No. 0 copper. Witnesses were produced to prove that at several other times horses had been shocked and knocked down at this same place, but the Court overruled this testimony. The plaintiffs here rested their case, and counsel for the defense made a motion for a non-suit, which was denied by the court.

The first witnesses for the defense were as to the bad character of the horse, and that the runaway was caused by the harness breaking. Experts were then produced, who swore that the system of iron bonding was all right, Mr. Bourne, of New York, admitting, however, that in the last four years he had only built one road with iron bonds, that at Bridgeport, and even there they used a double-lace No. 0 wire, with overhead return feeders.

Col. Perrine, the former president of the road, testified that at the time the road was built, in 1892, iron bonds were in general use, though since abandoned. In his own new road he used copper because it was cheaper. He considered that in a recently laid track 90 per cent. of the return current passed from rail to rail by means of the first plate joint, and the other 10 per cent. by means of the bond wire. When asked if he did not know that current was constantly escaping into the earth from the rails even of a well-bonded track, he said he did; but when asked what became of it he said it just simply disappeared, vanished. The next question was if there were an ammeter on the return side of the dynamo, and another ammeter on the outgoing side, would they read the same? Witness replied that there would be a difference.

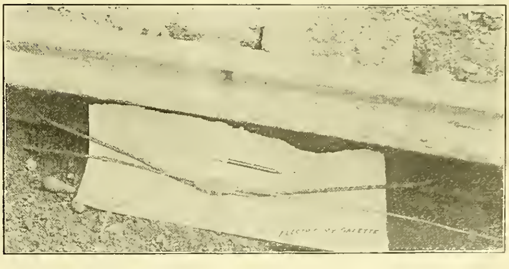


FIG. 4.—BONDING AS IT EXISTS IN THE GROUND.

Prof. Moore, of Princeton, gave the jury learned definitions of most of the technical terms used in the case, and then in answer to the question: "State whether . . . there is less liability to shock when the ground is wet than when it is dry," said: "Other conditions being presumed the same, yes, sir."

He testified to having made experiments to test the difference of potential between rail and ground when 13 cars were on the track, without finding any proportionate increase with the number of cars, but he admitted, however, that the season has been very dry, and that the current does not leave the rail to go through dry earth.

He had measured the resistance of the track and found it .62 ohm per mile. This he considered very low. In rebuttal Mr. Woodbridge, of New York, testified that he had made track measurements, and found .03 ohm, which he considered rather high. Prof. Moore's figure works out the sum of 250 volts per mile of track, with 400 amperes. It is evident that the resistance is not so low as it might be.

It was brought out on the cross examination of Prof. Moore, that when he made his measurements for the resistance of the ground return, he measured the track just as it stands to-day. It was then shown that since the time of the accident another road had been built, crossing and connecting with the original road. In reply to a question, witness stated that the fact that this road had been constructed since the accident, would have no influence on the resistance of the track return as it existed at that time. On further questioning as to the additional conductivity afforded by the newly constructed portion, the witness said that at any rate, this had been carefully eliminated.

Prof. Moore produced a model to prove that it was easier to get a shock on a dry day than on a wet day. He had a tin pan connected to one side of a magneto, and a piece of iron connected to the other side, resting on some dry sand in the pan. When jurymen touched pan and iron they received a shock, but on wetting the sand, the shock ceased. Prof. Moore refused to submit to a new set of conditions as proposed by the experts for the plaintiffs, however, and was duly scored by counsel in summing up, the experiment as he arranged it being comparable to a horse having one foot on the rail and the other on the trolley wire. The Judge charged the jury as to the law in the case, and after being out several hours, they brought in a verdict in favor of the plaintiffs, naming damages.

Ties and Poles.*

BY N. W. L. BROWN.

In 1890 the Fulton County Railway Company built several miles of tracks in Atlanta, in which 40 lb. and 45 lb. rails were used. In suburban and unpaved tracks the rails were spiked directly to pine ties. In paved tracks they were supported on four-inch chairs. The paving was of Belgian blocks, supported simply on three inches of sand and provided with a sand filling. The ballast for the track would seem to have been about three inches of sand. These tracks are now owned and operated by the Atlanta Consolidated Street Railway Company, and it was fully two years ago that we were forced to make a few renewals of the ties under them.

About one year ago the ties under the suburban tracks had to be almost entirely renewed, and the paved tracks began to develop serious defects from rotten ties. We considered that the short life of these ties was due to the use of inferior timber, and we hence did not give the situation any serious thought, but recently we have seen tracks going to pieces from rotten timber, which were built in 1891, and known to have been built of first-class pine, and a thorough examination has shown conclusively that six years is the longest life we may expect of select pine.

In tearing out horse-car and dummy tracks we have frequently found oak ties of which accurate records could be had, and from these we are led to believe that eight years is the longest life we may expect of oak. These lives, which correspond closely with those met with in railroad experience here, and in many sections of the North, have caused great disappointment, since we had expected the location of our ties beneath paved streets to have a great preservative effect upon them, in accordance with the experiences reported by many street railway engineers.

As timber will not decay when frozen, or constantly submerged in water, and as certain ingredients in different soils tend to hasten, while others to retard, decay, it may be that our experience in an equable climate, in a well-drained city, and upon the red clays of Georgia, differs widely from that gained in other localities, still we cannot think our conditions ought to differ greatly from those met with generally. In railway experience ties covered up and poorly drained, decay more rapidly than those in ballasted and well-drained track. Remembering that street railway ties are poorly drained at best, and that they are, even with the best paving, liable to be wet by every rain, and to be constantly changing their state of dampness, and remembering, too, that the ties and rails vibrate even in the most solid construction, and hence are in contact with the air, we cannot see why street railway ties should ordinarily last longer than buried railway ties. We have gone quite thoroughly into the advisability and economy of using ties of greater first cost and longer life.

We have conferred with many street railway engineers and find positively no uniformity of opinion or practice as to the best tie to use. One engineer prefers and uses oak, another tamarack, another chestnut, another cedar, another cypress, another Georgia pine, and a very few engineers claim to have solved the problem of ultimately the most economical track construction by adopting metal ties.

It seems to be generally conceded that metal ties require for their proper foundation a thorough bedding in concrete, and if it is granted, (as is claimed by a few American and many English and Continental engineers) that a concrete foundation is necessary in any good track, then the selection of metal ties may bespeak good judgment in deep rail construction; but most American engineers claim that concrete is not necessary in first-class track construction, and if this opinion (in which we heartily concur) is correct, then there can be few cases, if any, where metal ties would be most satisfactory and economical.

In New Orleans excellent results have been obtained under horse-car tracks with red cypress, which is reported to have been in good condition after 28 years of service. Red cypress, and especially black cypress, are among our most durable woods, but their extreme softness and inability to properly hold spikes have been a serious hindrance to their extensive adoption for railway ties. The extraordinary results reported in New Orleans are doubtless due to the light requirements of horse-car service, and the fact that these ties were always in very damp, marshy earth, if not actually submerged in water.

We have conferred with many members of the American Society of Civil Engineers connected with railways in the South and West, and we find among them a great diversity of opinion as to the merits and life of cypress timber, both for trestles and ties. This is evidently due to the fact that cypress, like other timbers, lasts better under certain circumstances than under others, and apparently also to the fact that considerable confusion seems to exist as to the proper classification of the different grades of this timber, white cypress being worthless, and red cypress itself (which is perhaps most extensively used) being a little inferior to black cypress. It is claimed that even the most expert inspectors can seldom distinguish one variety from another of this timber. Reports of the life of black cypress in trestles vary from eight to twenty years, averaging, perhaps, twelve or fourteen years, while its life in railway ties is variously reported between seven and twelve years, the average corresponding closely with that generally assumed to be nine years.

A prominent timber expert of our city estimates that black cypress in our tracks ought to last about ten years, and the information before us leads us to believe that this estimate must be about correct.

After consulting all the few reports and treatises available upon the subject of timber preservation, we have conferred again with many members of the American Society of Civil Engineers and other experts, and our opinion seems to be universally endorsed that efficiently creosoted tires are ultimately the most economical for use in street railway work.

At present we omit the vulcanizing process, which has in a few cases given good results, but whose merits are still in a measure in question. We can say that the processes for the preservation of timber in quantity are confined almost exclusively to two which are standard, and long established, viz., burnettizing and creosoting. Burnettizing, or the treatment with zinc chloride, is the process, (modified by patents in some cases) most extensively used in America for the preservation of railway ties, mainly on account of its small cost, its resistance to fire, and on account also of its being simpler or safer than the treatments by the injections of other metallic salts.

Burnettizing is extensively used in the West, and it has given good results, especially in dry localities, but there are many conditions met with in street railway construction which are unfavorable to its success. 1st. Zinc chloride is a salt easily washed out when exposed in wet localities. 2d. Leakage currents from the rails might hasten its disappearance. 3d. It has a tendency to rust the rails and spikes. The creosoting process was invented and established in 1838 by Jno. Bethell, of England, and for many years past it has been almost universally used in England and France for the preservation of ties and telegraph poles.

The average life of creosoted beech ties on the Northern Railway of France is 27 years. Properly creosoted spruce ties in England last from 16 to 20 years. It is reported that the mile of track laid of different kinds of creosoted ties on the M. N. O & T. R.R. near West Pascagoula, Mississippi, in 1869, showed when examined in 1886 that seven of these ties had been removed, one from rot and six from being cut into by the rail. Trestles built on the H. & T. C. R.R. 22 years ago were recently reported in good condition. Many cases have been reported in this country where creosoted timber was sound after 16 years of service.

Creosoted timber is in many respects peculiarly suited for street railway ties. Creosote cannot be washed out, and being a perfect insulator, is beyond the reach of the electrolytic action of leakage currents. It might have an important bearing (especially in stringer tracks) on reducing the leakage from the rails to the water mains, etc. Its tendency is to prevent iron and steel from rusting.

For a long time 6 in. x 8 in. x 7 ft. were our standard dimensions for ties, but over a year ago we changed these to 5 in. x 9 in. x 7 ft., and consider our present standard more satisfactory.

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* Read at the Convention of the American Street Railway Association, Montreal, Oct. 15-18, 1895.

In railway practice, where tremendous loads are carried upon low rails, it has been found that too broad a tie would rock itself out of a proper foundation in ballasted track, and it is on this account that broad ties are objectionable in ballasted railway work, 6 in. x 8 in. x 8 ft. being the adopted standard.

In street railway work, however, where deep rails are used and where this "rocking" amounts to nothing, we think a broad tie has many advantages over the narrow ones sometimes used.

We have recently used 3,000 sap pine ties from the Fernandina Oil & Creosote Works, and are expecting good results from them. These ties, treated with 12 lbs. of dead oil of coal tar (creosote) per cubic foot, can be delivered, f. o. b. cars Atlanta, for 60 cents each. First-class pine ties now cost us 26¼ cents each, oak in quantity 30 cents each and black cypress about 40 cents each.

With our present scale of wages the labor of tearing up and renewing track paved with ordinary Belgian blocks with a sand foundation and filling will cost about 36 cents per lineal foot of single track, so we can readily make a comparison for determining the most economical tie to use.

From the information before us, we feel sure that we can safely assume twenty-four years as the life of a creosoted tie, and with this assumption we will determine the cost of keeping the different kinds of ties under sections of track for twenty-four years.

Assuming the ties to be spaced 2 feet 6 inches apart, C. to C., creosoted ties will cost 24 cents per lineal foot of track, therefore 60 cents (36 + 24) will represent the cost of labor and ties per lineal foot in rebuilding. Principal and interest on 60 cents at 6 per cent. for 24 years, $1.46, which is the actual cost per lineal foot of keeping ties under this track for twenty-four years.

Cypress ties will cost 16 cents and 52 cents (36 + 16) will represent the cost of labor and ties per lineal foot in rebuilding where they are used. With a life of 12 years, which is generally assumed as the maximum in railway practice, two renewals would be required in twenty-four years; therefore for the first renewal, principal and interest, 52 cents, at 6 per cent. for 24 years, $1.27; and for the second renewal, principal and interest, 52 cents, at 6 per cent. for 12 years, 89 cents, making a total of $2.16.

Oak ties will cost 12 cents per lineal foot and 48 cents (36+12) will represent the cost of labor and ties in rebuilding, where they are used.

With a life of eight years three renewals would be required in 24 years, therefore the cost for principal and interest would be $2.82.

Pine ties will cost 10½ cents per lineal foot and 46½ cents (36+10½) will represent the cost of labor and ties in rebuilding, where they are used. With a life of six years four renewals would be required in 24 years, and the cost for principal and interest would aggregate $3,077.

From these comparisons we see that with the lives assumed, cypress will cost 48 per cent. more than creosoted timber. Oak will cost 92 per cent. more than creosoted timber. Pine will cost 111 per cent. more than creosoted timber.

These comparisons assume that the service of the different ties during their lives is equally satisfactory, which is practically correct in the case of oak, pine and creosoted pine, but cypress, on account of its softness, gives inferior service.

These figures take no account of the disturbance to travel and to residents along the street while renewals are going on, nor do they consider that repairs are necessary long before complete renewal, and that these repairs would be much less where the track was going to pieces once than where it was going to pieces several times within a given time.

We have assumed in this comparison contract prices on creosoted ties delivered here by rail from a point many hundred miles distant, and while we believe that street railway companies can creosote their own timber at much less cost generally than they can expect to have it done by contract.

These creosoting establishments are generally extensive affairs, and while they may be kept busy for months at a time we think it is a fact that their interest on investments, salaries for expert superintendence, sales department, labor, etc., are much more regular items at least than their orders.

We feel that it would be economy for any street railway company operating extensive mileage, and affected like ourselves with short-lived ties, to install a small creosoting plant on the power-house premises, which are generally large, and supply this plant with steam from the main boiler plant, and with power for its pumps, etc., by means of electric motors. In this way expert superintendence could be given by the chief engineer, the plant could be operated most economically, and when lying idle the interest on the cost would be about the only expense connected with it.

A porous wood is necessary for proper treatment, and while beech, on account of its great toughness, seems to give better results than almost anything, spruce and sap pine are standard articles for treatment. In many localities, especially in the South, this sap pine timber, which is in little demand ordinarily, can be had at a very low price, and with a plant installed and operated in the manner outlined above, we feel sure that these ties could be purchased and treated at a total cost not exceeding 40 cents each.

We estimate that a plant, consisting of a treating cylinder, 6 feet in diameter and 36 feet long, with a capacity of about 300 ties a day, should not cost more than $6,000 complete with necessary cars, pumps, tanks, superheating apparatus, etc., necessary for operating it. Not only would such a plant be of service for ties, but also for treating floor timbers for cars, trestle and bridge timbers perhaps, and especially for treating cross arms.

POLES FOR LINE CONSTRUCTION.

Red cedar poles have been almost universally used in our overhead construction, although iron poles set in concrete have been used in the heart of the city, and cypress poles have been used in a few cases when we could not secure cedar promptly.

The specifications by which most of our cedar poles were purchased required 28 feet in length and a minimum top diameter of 6 inches, but these poles proved too small, and, in many cases, too short, especially where guard wires are required.

These red cedar poles for this market are generally obtained in East Tennessee, although the timber exists more or less bountifully in many sections of the South. It has been used almost exclusively by the Western Union Telegraph Company, and they estimate that their poles last on an average about 15 years. The sap generally decays in five or six years, and in many cases they find that the heart decays in 12 years, while again in many cases it will last 20 years.

Cedar poles, especially when used according to the ordinary custom, have many defects in street railway service.

1st. Their life is practically limited to the life of their sap, as when this decays the heart left is too small and weak for reliable service.

2d. Larger poles are liable to be very defective, generally being hollow at the butt, and frequently containing rotten knots.

3d. Cedar is very brittle and treacherous under tension.

4th. Large, short poles are excessively expensive, as they are equivalent on the market to long poles cut off.

We are now estimating that our cedar poles with large hearts will last 12 years. The cedar poles we have used appear to have cost us about $4.00 each, erected. Our iron poles which have cost about $18.00 each, erected, do not appear to be lasting as well as was hoped. They have too great a tendency to rust near the ground, and we doubt whether they can be safely depended upon for more than 15 years.

We believe properly creosoted pine poles, 30 ft. long and 8 in. at the top ordinarily, and 10 in. to 12 in. at the top where special demands are made upon them, should be equal in point to excellent service, and superior in point of long service to any poles on the market.

These poles, treated by contract to 10 lbs. of creosote per cubic foot, should not cost more than $5.00 each erected, and when treated in one's own plant, this price could doubtless be reduced to $3.50. Pine in its growth is one of the most perfect and symmetrical of all timbers, besides having a tensile strength about twice as great as cedar. Creosoting is generally conceded to increase the strength, and all these properties would seem to indicate that the creosoted pine pole should be strong enough and neat enough for city work, but it is the long life that makes this pole most eminently suited for street railway work.

Mr. W. H. Preece, the celebrated English telegraph engineer, reported in 1884, as a result of thirty years of experience, that he had never seen one single properly treated telegraph pole which showed the least decay, and he referred to 318 poles, which after 35 years of service were torn down to make way for larger poles, every one of which showed after this service no signs of decay. Creosoted poles are universally used in English telegraph work. A district superintendent of the Western Union Telegraph Company tells us that he was recently asked to examine a lot of creosoted poles, supplied to his company for experiment by the works at West Pascagoula, Miss., 12 or 15 years ago perhaps (as well as he remembers), and that he found every one in perfect condition. He dug down to the bottom of many, and could find no sign of decay. Creosoted poles installed near St. Augustine, Fla., in 1888, have within the past few days been examined fully, and are reported by the superintendent of the Western Union Telegraph Company to show as yet no trace of decay. Creosoted poles have a great advantage in being perfect insulators over iron poles, which are grounded conductors, and liable to cause accidents to the lines and linemen.

If creosoted poles are superior to cedar in almost every respect, the question naturally arises, Why are they not adopted by the Western Union Telegraph Company? This question is easily answered. Most of the poles of this company are along the railroads and insecurely protected against fire. A creosoted pole is very inflammable, and they are afraid this one great disadvantage in their work would more than offset its advantages.

Much has recently been done toward developing to perfection the rational standards in street railway engineering practice, but we feel that these standards in track and line construction would be, as a rule, improved by the use of creosoted timber.

CHESTER, PA.—The project to build the Chester & Wilmington Electric Railway from Shellpot, to a point on the State line, to connect with another line in Pennsylvania, from Chester, seems to be resting. President, James C. McComb.

DU QUESNE, PA.—The White Electric Traction Company has notified the borough that it is ready to continue its line to the northern limits of the borough, to connect with the Homestead and Highland line, which is being extended from Munhall to Du Quesne.

The Present Status of the Air-Brake.*

E. J. WESSELS.

Last October the speaker had the honor to lay before the members of the American Street Railway Association in Atlanta a paper on the subject of "Power Brakes vs. Hand Brakes." In that paper reference was made to the advantages of a good air-brake and the desirability of its adoption on roads with congested traffic, high speed or severe grades, and especially where trailers were used.

At that time the street railway air-brake was in swaddling clothes. Some, not positively indifferent on the subject, proved hostile. When asked their objection to its adoption, they generally answered: "The air-brake costs too much." Some of the members asserted that hand-brakes answered their purpose, and they saw no need for substituting air-brakes. The speaker claimed that every car should have both air- and hand-brakes.

To contend against this opposition has not been easy. It takes a long time to convince some men that first cost may not mean much and often in reality proves but a forerunner of excessive outlay. *Per contra*, sometime things said at the start to "cost too much," are cheapest in the last analysis. Prices must be judged by relative values and mean nothing unless one sees the apparatus.

In considering the present status of the air-brake it is pleasing to notice that the indifference which existed even in influential quarters has largely disappeared. Months ago a prominent railway president asserted that he would not put an air-brake on his road because, if he did, there would be nothing for his motormen to do. Since then he changed his mind and recently contracted to have every car on his road equipped with air-brakes.

It was asserted in the speaker's Atlanta paper, and may be proper to repeat here, that the object of the present paper is not to advertise any special make of air-brake, but to call attention to air-brakes in general, applicable to passenger and freight electric and cable cars. Most managers now concede that the old form of hand-brake will no longer answer for heavy, double-truck, high-speed cars. There has been a remarkable change of views since we last met. It is now admitted that more reliable braking apparatus must be secured. In fact in several quarters even the question of expense cannot be said to be the chief one. Some go so far as to say, "We must have better brakes at any price."

There are instances on record where certain roads have contracted for more reliable braking apparatus at a cost which a year ago they regarded prohibitory. In their extremity these roads naturally turned to those manufacturers who have made air-brakes a study.

It is manifestly inadvisable for a street railway company to turn out its own brakes. The question is such a difficult one, the outlay for experiments is necessarily so immense, that no individual road is justified in undertaking the business. Some roads build their own rolling stock, but it is easier to build cars than air-brakes. An air-brake which has merely been tested in the shops is of doubtful utility. It cannot be depended upon for the rough usage it will encounter in service. No air-brake is fit to be mounted on a car which has not gone through the most crucial tests based on records of similar brakes operated on cars for many months.

To design an air-brake which shall be mechanical, durable and economical is one of the most difficult problems a manufacturer can face. It is comparatively easy to design apparatus which will work admirably if left undisturbed in the shops; but that same apparatus, when transferred under a car, in a short time may be battered beyond recognition.

The street car air-brake has much to contend with:

Firstly. The unfamiliarity of the average motorman with the proper use of air is greatly against it.

Secondly. The compressor is begrudged space on the car axle, although generous space is freely given to electric motors irrespective of dimensions. This makes it difficult to have proper bearing surfaces.

Thirdly. The neglect of proper inspection is greatly against the air-brake. Even motors do not receive the attention they should, as many a scrap heap testifies. The air-brake hardly receives any.

Fourthly. Insufficient lubrication. The same man who lubricates his motors passes by the air-brake without using his oil can. Probably he might neglect to oil the motors, but know that failure to do so would be speedily detected and render him liable to discipline. The air-brake has not reached that point in street railway operation where neglect to lubricate it produces like results. The most perfect apparatus ever designed, if neglected, cannot do its work properly, and no automatic oiling machinery or mechanism under a car can possibly replace human vigilance.

A year ago the air-brake was not found on many roads. On the few roads where it was being used, satisfactory results were obtained, and in the *Street Railway Journal* for March last, in the article entitled "The Street Railway System of Buffalo, N. Y.," a report of the successful operation of air-brakes there will be found. It showed that by using air-brakes there had been a great saving in wheels. As a matter of fact, there should not be any flat wheels if air-brakes are properly used, for by their aid pressure can be regulated to a nicety.

Any good brake is better than a poor one, and we welcome into the family our friends who since last Convention have put on the market several excellent types of mechanical brakes.

As, however, in street railway practice we are closely following (if not really leaving behind) steam practice, it is reasonable to conclude that if mechanical brakes were the solution of the braking problem they would be found on steam roads instead of the well-known Westinghouse air-brake. An examination of the patent office records discloses the fact that scores of patents have been granted for mechanical brakes for steam cars, but one would have to travel far to find a solitary mechanical brake in service on steam roads. If they have proved unfitted for steam practice, and the air-brake has been adopted, it is fair to assume that mechanical brakes may not be all that is required for braking electric and cable cars. It is always better to replace human muscle by some controllable potent force, and compressed air, under proper conditions, seems to be that ideal force.

The speaker recently returned from an extended trip through Europe. He rode on hundreds of cars in different places, from the north of England to Budapest, but did not find a brake on any steam road operated by anything but air, vacuum or steam. Investigation proved that air-brakes were much preferred to all other forms. Some trains used the automatic, some the non-automatic. He also found that inspection on most lines was ideal. Not only were the brakes tested, as we test them here, but on many of the trucks diagrams were painted with the words "To be lubricated every so-many days." It was the duty of the car tender to chalk in the squares painted underneath the days when apparatus received attention.

The street car air-brake has been adopted by the Australian government; it has been specified by borough engineers in Great Britain; it is being installed in different places on the Continent. It is, therefore, somewhat discouraging to find that while the street car air-brake receives very careful attention abroad, it is denied that attention here. It is unfortunate that our managers entrust it to uninstructed men who have had no experience in its use. No one anywhere would be permitted to handle the Westinghouse triple valve who had not served his apprenticeship of from three years upward, and firemen are not allowed to touch it. The locomotive runner is alone entrusted with it and held strictly accountable for its misuse. More than one runner has been discharged for bad use of his pressure.

The street railway air-brake is entrusted to green men who sometimes don't know enough to use their electric apparatus properly. The air-brake for steam roads has undergone an evolution beginning in 1869. Even its most ardent supporters will not claim that the system as applied to-day is absolutely perfect; but it is commercial and unquestionably has saved hundreds of lives in the past twenty-seven years.

If it has taken that long to bring the present steam car air-brake to a measurable degree of perfection, what may we not hope to see accomplished by the street railway air-brake in a very much shorter time.

There is a book which has reached a third edition entitled "Diseases of the Air-Brake System; Causes, Symptoms and Cure," devoted exclusively to steam road air-brakes. This, too, after twenty-seven years' experience. Should we expect perfection in the more youthful street railway air-brake which has only been in existence for some three years?

The duties required of a street railway air-brake are more severe than those demanded of a steam car air-brake. The steam train makes very few stops. The stations are well-known and the roads are provided with proper gate crossings and the block system. In numerous places grade crossings have been or are being abolished. Even the engineers of the Empire State express do not face the risks to which the motorman of a fast, suburban electric train is constantly exposed. The electric train very often stops where there are no stations, where passengers stand between the rails frantically waving so they will not be left. There being no definite time when the train passes cross-roads, the motorman of the electric train is menaced by farm wagons and other vehicles, deaf people, bicycle riders and others, who would not attempt to cross the track if the Empire State or other express was due. It is placing a motorman at fearful disadvantage to entrust him with a 25-mile-an-hour (and more) train, as is now being done, and failing to provide him with the necessary means for emergency stops.

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* Read at the Convention of the American Street Railway Association, Montreal, Oct. 15-18, 1895.

The air-brake is the only brake which has an emergency stop that can be instantly applied by the easy turning of a handle. Other brakes require muscular effort and generally a number of turns before the braking power becomes effectual. In order to have even an approach to an emergency stop, it is generally necessary with hand-brakes to gear them to a point which they would never reach were the semblance of such a stop not required. This excessive gearing means rapid wearing of parts and needless tiring of muscles.

It is not claimed that the street railway air-brake has reached perfection. It is believed it never will reach that point unless through the co-operation of the railway managers. But even though it is not claimed that the present street railway air-brake is all it should be, we must admit it has made remarkable strides, that satisfactory results have been produced, and that it is commercial. It will not be possible to overcome all the objections to an air-brake unless managers rally around the men who are striving to reach perfection. It is only by braking cars in actual service that important knowledge of the air-brake can be gained. There were air-brakes which entered the lists at the last Convention, which have retired from the field, but some are still bearing the heat and burden of the day. It is a case of the survival of the fittest; but even if an absolutely perfect air-brake were in existence, it would stand jeopardy every hour, so long as an uninstructed motorman is permitted to handle the controller.

Those of us in the midst of the conflict do not despair of being able to turn out an ideal air-brake which will operate satisfactorily under all conditions. If that brake could be delivered to-day and would pass muster before a jury of microscopists, there would still be the factor of neglect and inattention of motormen to contend with.

We may not, in this stage of the art, expect that leading roads will maintain schools of instructions, nor can the manufacturer of air-brakes, from the low selling price, support such institutions; but surely it is reasonable for them to expect that motormen should undergo preliminary instructions, and that the simple operating directions shall be faithfully adhered to.

When a man applies for admission to the police force he must undergo a severe examination. One of the questions recently asked was: "If there were 4,796 persons in a district and there is one Swede to every three Germans and five Irish, how may Swedes, Germans and Irish are there in that district?" If this sort of an examination is required of policemen, should not suitable tests be applied to motormen?

The speaker recently read a letter from which the following is quoted as giving evidence of what the air-brake has to contend with in some places: "This is by all odds the dirtiest city in the world. Our men are of the lowest degree of human intelligence, utterly incapable of understanding or taking care of any kind of machinery. We are unable at times to keep our cars on the road for lack of motormen. Another difficulty is the possibility of braking the car with current on. Our men are also incapable of appreciating that a little is frequently enough and almost invariably bring the car to a full stop when they only wish to slow down."

Fortunately in the United States such a deplorable lack of intelligence does not exist. Our motormen are far more intelligent, and the recent prolonged financial depression has enabled managers to secure better men than were formerly obtainable. It is gratifying to find that many motormen are anxious to improve their condition and to become more useful to their employers. Many of them send in requests for literature, so they may have a more intelligent idea of the apparatus entrusted to them. This is true of many. We cannot overlook the fact that there are others not so desirable, men who have little ambition and who expect to remain motormen as long as they are able to turn a handle. These claim they render a fair equivalent in work for the wages paid. They forget that the way to secure higher wages is first to show greater proficiency. They remind one of the brakeman who was complained of by the passengers for not announcing stations distinctly. His defence was that he could not be expected to sing tenor for $30 a month.

The cry about the trolley slaughter has subsided. Six months ago it had reached large proportions, but the riding public is beginning to realize that even if managers are anxious to minimize accidents, they cannot reach the safety point unless a superior class of apparatus is within their reach.

DISCUSSION.

MR. SCULLIN, of St. Louis: About two years ago we tried two air-brakes. The main trouble with them was experienced when cars were run through crowded sections. Then the speed was so slight and the stops so frequent, that it was almost impossible for us to keep the pressure strong enough. We also found that on account of connecting the vacuum brake to the same rod as the hand-brake, the hand-brake was constantly neglected, and it became almost impossible to use it. In the suburbs we had no trouble in keeping the pressure. Another objection resulted from the fact that we had old motors, and the wires coming in contact with the piping of the brakes, wore the insulation off of the wires and short-circuited and burned holes through the pipe.

MR. WESSELS: I would say in response to that question that no air-brake is fit to be in service which has not always available a minimum of 50 stops in reservoir capacity so that if there should not be any movement of the compressor available power for 50 to 100 stops is always present.

MR. WOOD, of Darby: Is the noise of the exhaust sufficient to frighten horses?

MR. WESSELS: I know of one brake in which the exhaust has been silenced, and there is no hissing or escape that is noticeable.

MR. MCCULLOCH, of St. Louis: The managers of one of the roads which run parallel with one of our lines were so sure about two years ago that they had everything that was desirable in the way of an efficient air-brake that they equipped a very large electric car; seating 52 persons. It was run for some time. They sent out invitations to all of the street railway people and others in St. Louis who might be interested in such matters to go with them on an excursion on a suburban road, some 12 or 15 miles out, to see how efficient this air-brake was in its operation. Everybody was very much pleased with it. The motorman with his little finger could stop the car without any effort whatever. The managers of the road were so pleased with the operation of the brake that they equipped a number of their cars with it and spent considerable money in doing so. By the time they had 10 or 12 cars equipped bills for repairs began to come in, and they called a halt in the matter. The result was that no more cars were equipped with air-brakes, and to-day they have not an air-brake in use. They found they could not keep the brakes in such condition that they were always reliable. As I understand it, the trouble arose principally from the fine particles of dust cutting out the packing in such a way that there were leaks which could be taken care of only at such expense that it became prohibitory, and to-day there is not an air-brake in use in the city of St. Louis, although they had such a splendid start.

MR. WESSELS: In the paper presented the statement was made that there were air-brakes entered in the list at the last convention, which have since disappeared, and the particular type referred to in the paper is the type of which Mr. McCulloch speaks. There were five put in service on the St. Louis & Suburban road, and the management of the road thought so much of the brakes that when the original brakes broke down they rebuilt them and started them again, because they realized most emphatically the necessity for having air-brakes.

MR. SEELY, of New York: There is no doubt about their being a field for an air-brake on electric railways. Our great steam road systems are not considered up to date unless they are equipped with air-brakes. There is no reason why they should not be utilized, especially on suburban roads. The first experiments may not all have been successful, but there is not reason why they should not be perfected.

An International Compliment.

The following interesting conversation between two ladies (one of whom evidently belonged to Montreal, while the other was her guest from some other city) was overheard in a street car as it passed the Winsdor Hotel on one of the days of the recent street railway convention in that city:

MONTREAL MATRON: "The street railway men are holding a convention at the Windsor just now."

HER GUEST: "So I understand."

MONTREAL MATRON: "In 1891, when the electric light men were here, we opened our houses to them and entertained them loyally. We were glad to have had the privilege, but we are not entertaining the street railway men to any extent. We had to draw the line somewhere, and we drew it at conductors and motormen!"

HER GUEST (glancing toward the entrance to the Windsor, at which stood a group of well-known delegates, including H. M. Littell, Col. John H. Cunningham, "John" Brill, Russell B. Harrison, Capt. Candee, D. G. Hamilton, E. W. Little, "Tom" McLean and A. C. Littlefield): "But what distinguished-looking and fashionably-dressed men these street railway employees are!"

MONTREAL MATRON: "Yes, very! They certainly appear to have a much better class of conductors and motormen in the States than we have in Canada!!"

Report of the Committee on Patents.*

Among the many perplexing problems that have demanded the attention of some of our Western street railways is the question of "worthless patents," and it being evident to several gentlemen of the street railway fraternity, that an association to handle all matters pertaining to patents, as affecting street railways, would be highly beneficial to all concerned; a committee was appointed at Atlanta to take up the matter and submit a plan of organization.

The majority of street railways have, at one time or another, in their history, been sued for using or making some device, which was an alleged infringement on some patent. These cases were either fought out in the courts, or settled by the railway company, rather than go to the expense of court costs and attorney's fees. A large proportion of railways have paid and are now paying royalties, either directly to the patentee, or indirectly to the manufacturer (the royalty in the latter case being included in the price of the article paid by the purchaser), on certain articles in use on their systems. These direct royalties are often paid when exacted, to avoid going to the expense of hiring an attorney to look up the patent papers to see if the claimant has a good patent and a valid claim to his royalty. The writer knows this to be the case with the company with which he is connected. The expense of investigating such matters is often more than the amount involved, hence the matter it settled upon the payment of a few hundred dollars. The manufacturer should stand the burden of infringement suits and not the purchaser, and the advantage of an association of this kind would be to influence or compel the claimant to direct his suits against the manufacturer and not the railways. Since the adoption of electricity as a motive power, we find that the number of patented articles in use on street railways has increased wonderfully. We are confident that a large number of these patents are worthless and will not "hold water."

Were these alleged patents to be investigated, a great number would become common property, on account of the patent feature becoming eliminated, and hence the patentee would be deprived of his royalty, and the manufacturer would at once reduce his price in consequence. We do not mean to say that the honest inventor is not entitled to his royalty, provided he has a good bona fide invention. It is clearly evident that if the street railway companies were combined together in an association of this character, that the expense to each would be small, while the advantages will be manifold. Another important item will be the assistance of the association in advising its members concerning new inventions of their own employees whether these were patentable, or whether infringements on other inventions, said assistance to be furnished free to the railway companies which are members of the association. This will serve to encourage employees to work out improvements in devices in use on street railways and protect them in their rights. The advantage to the company presenting such new invention would be that it would be permitted to use the device free of royalty.

A great many devices in use in our system are common property at the present time from the fact that the patent has expired, yet how many members of this Association know the expiration of the patent limit on a single device in use on their road, and in ignorance of such facts are still paying the same old price.

The idea of such an organization of this kind was prompted by the fact that two similar ones have been in existence for over 24 years for the benefit of the steam railways, and have been highly successful in every detail. One of these associations is located in the East and the other is located at Chicago, and the two include as members all the important railways in the country and a large number of the smaller roads.

We have had several conferences with the general counsel of this association, and he has been very kind in giving us information regarding the workings of his association. He also declared that an association of like nature for street railways will be highly beneficial to all concerned, and recommended it.

This Association is maintained by an annual assessment of its members based on the gross earnings of the several railways, payable in quarterly installments. The expenses of the Association consist of the salary of an attorney, office help, rent, traveling expenses, court expenses, patent office books, pamphlets, etc., and is conducted on a more expensive scale than would be necessary in a like organization for street railways.

The Western Railway Association has won about four fifths of their suits, and stands all expenses connected with its suits, but does not, of course, pay any judgments; the defendant road paying any judgment that may be entered. The entire membership, however, obtains the benefit of all such trials. The work performed by the Western Railway Association in 1894, if done through the regular channels by the roads themselves, would have cost about ten times as much as was paid to the Association during the year for same. It is the practice of the roads belonging to the Association not to put on any new device without first referring the same to the Association for advice. The number of suits against the railways have been reduced very materially since this Association was started, and $60,000,000 in judgments were defeated in one year. One of the large trunk lines paid $10,000 for using a patented article that was afterward found to be worthless as far as the patent feature was concerned.

A certain street railway, so we are informed, paid $1,500 to prevent suit on an alleged infringement, and the patent was worthless, as was afterward learned; this might have been saved if an organization of this kind was in existence. One of the roads represented at this Convention is negotiating at the present time with two different firms on matters that could properly be referred to an association of this character. One of the articles in question is used by all electric railways in large quantities, and the inventor is receiving large royalties from the manufacturer. A patent attorney informed the road that he thought the patent worthless, but it would take a law suit to convince the manufacturer. If this be true, this road would have saved ten to fifteen thousand dollars by having this matter investigated at the start, saying nothing about what others would have saved that are using this article to-day and are paying the manufacturer whatever he chooses to ask. The other device referred to can be manufactured by the companies themselves, which is also true of the former article, and has recently come into use and is being used by several companies in large quantities. The patentee is willing that the street-car companies manufacture said devices themselves, providing they will pay him a large sum of money for the privilege of so doing—the company already having paid him many thousands of dollars for furnishing said article up to this time. We understand that a similar device has been used by another manufacturer in the past, though for some reason it was not patented. This being true, the patent is worthless, and his demand for royalty would fall flat were the same taken to the courts for settlement. These two matters are still unsettled, and are very important to the roads in question, as well as to others who are members of this Association and are using the same device.

Another important feature in this connection would be the collecting of different patented devices in use on our system, the same to be preserved and open to the inspection at all times of the members of the Association. In short, we might sum up the most important points as follows:

1. Lessening total expenses in fighting patent suits, etc., as a suit affecting one road would affect all.
2. Uniformity of action.
3. Additional safety in putting on new devices.
4. Greater facility in defending suits, etc.
5. Decrease in number of suits and claims on account of the existence of such an association.
6. Advantage in settling suits.
7. Contesting and avoiding unfair and unjust royalties.
8. Reduction of prices on all patented articles.
9. By members refusing to buy articles where suits are brought against any of its members, thus shifting suits to the manufacturer.
10. The dissemination of valuable information to its members of all matters relative to any suit, etc., in which one or more members are the interested parties.
11. Advantage of employees of street railway companies in getting valuable information and assistance on their own inventions, whether patentable or infringement of other devices, without additional cost to said railway or employee.
12. The acquiring of a full and authentic report of all devices that are commonly found in use on all street railways, such as fare registers, brakes, rail bonds and numerous other articles, giving the expiration of all such patents, opinion on the validity of the same, etc., and to be followed up with like reports from time to time, giving list and opinion of such patents and list of expired patents.
13. The acquiring of models, devices, etc., for permanent exhibition.

In conclusion, your committee desires to express two plans of carrying into effect the above scheme, and recommends that the Association adopt one of the following methods:

1. Provided the members vote to increase the scope of the Asso-

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* Read at the Convention of the American Street Railway Association, Montreal, Oct. 15-18, 1895.

ciation, we recommend that a bureau be established to handle all matters pertaining to patents as outlined in this report.

2. Provided it is not deemed best to enlarge the scope of the Association at this time, we recommend that the Association pass a resolution providing: That the annual dues be divided into two classes, regular and special (or if necessary the by-laws be amended to that effect). That all members be required to pay the regular dues as already provided in the by-laws, and that it be optional with members to pay the additional or special dues. That members paying special dues will be entitled to all the benefits to be derived through the agency of a patent bureau, to be established under the direct control of the American Street Railway Association. That the special dues be based upon the gross earnings of the several roads. That the Association elect a board of control, consisting of three members, whose terms shall expire in one, two and three years respectively, and hereafter electing one member each year. Said board of control to establish and carry on a patent bureau, as outlined in this paper, with the funds paid into the American Street Railway Association as "special dues." Provided further that no street railway company be entitled to the benefits and privileges of said patent bureau, except they are regular members of the American Street Railway Association.

Report of the Committee on Ways and Means, and Discussion.*

The Report of the Committee on Ways and Means, presented at the Montreal Convention of the American Street Railway Association, was followed by an extended discussion. The report and discussion are presented herewith.

REPORT ON WAYS AND MEANS.

Your Committee recommends that the several members of the Association be requested to contribute a sum not less than $15 each to liquidate the floating indebtedness of the Association, amounting, as stated in the report of the Executive Committee, to the sum of $4,087. Your committee believes that the amount thus realized, together with the net revenue to be derived from the rental of space in the exhibition hall, will be sufficient to pay all present indebtedness.

And your Committee, in order to prevent recurrence of any deficit, further recommend that the practice heretofore established of giving to the members of the Association banquet tickets, be discontinued, and that hereafter a uniform charge of $5 be made for such tickets.

Your committee recommends the adoption by the Association of the proposed amendments to Article 3 of the constitution, and Article 7 of the by-laws, introduced at the Atlanta meeting of the association, which proposed amendments received the unanimous approval of the Executive Committee and the association itself at the Atlanta meeting as follows:

Article 3 of the constitution shall be amended so as to read as follows:

"Section 1. There shall be two classes of members—active and associate.

"Section 2. Active members shall be American street railway companies, or lessees, or individual owners of street railways, and each member shall be entitled to one vote by a delegate presenting credentials.

"Section 3. Associate members shall be individuals or firms, or companies not embraced in Section 2, who have been recommended by an active member. Associate members shall not be entitled to vote."

Article 7 of the by-laws shall be amended by the substitution of the word "Tuesday" for "Wednesday," and by the addition of the following words to the first sentence, namely: "and shall continue four days."

DISCUSSION.

Mr. Hamilton, of St. Louis: This report is based upon the assumption that the deficit is $4,087. As stated when the report of the Executive Committee was read, the four thousand dollars is for past indebtedness and does not include any of the bills for the banquet and other expenses here. We have in the neighborhood of two thousand dollars expense here, in addition to the other, which will make it amount to over six thousand dollars.

Mr. Harrison, of Terre Haute: The committee believes that from the way we have received such liberal responses up to the present time, we will raise a larger sum than four thousand dollars. They also believe that by the adoption of the report providing for associate members, that it will bring to the Association for the coming year, from $7,500 to $10,000 over and above the annual dues that become due and payable on the adjournment of this Convention, which will be from 175 companies, or in the neighborhood of $3,500, giving the association more funds than it has ever had before in its history, and put it on a substantial basis, financially.

Mr. Thompson: Now we can discuss this matter intelligently. It is a question if you street railway men who are putting up your money and investing it in street railways, are going to permit outsiders to come in and put up their money and run your Association. I think the street railway companies that are represented here are able to discharge the debt. All that need be done is to say: "We will charge you in proportion to your income," and let them levy it right here, without having a subscription. Admitting the voluntary subscription to be all right, to predicate it upon the adoption of something else, to my mind—and I say it very plainly—is the worst thing you can do. We have the greatest amount of respect for the material men, but we do not want them as members of this Association. If this is to be an association maintained by American street railway companies, let them maintain their organization and pay the reasonable and legitimate expenses for the diffusion of knowledge that will be a benefit to the parties concerned. If the parties who sell material want to come here and show their exhibits and call the attention of the delegates to the proper running of the road and the proper parties to buy of, who has the best equipment at the most reasonable price, that is the proper thing. But if you permit these gentlemen to come in here and talk, they will certainly have a great influence upon the voting power. The report of the committee shows certain subscriptions; if there are not enough there, ask the railway companies to contribute so much more, but do not predicate it upon the adoption of these resolutions. While my road is a small one, we are willing to pay an extra hundred dollars, and I will say now, put that down on the subscription list, but not in the way in which it is done.

Mr. Harrison: We are not recommending the adoption of any by-laws that have not been thoroughly discussed by members of the Association. Every one has received a report of the last meeting, and in that report it is stated definitely that the by-laws recommended received the approval of the Executive Committee at the Atlanta Convention, and also received the unanimous vote of the members. We do not propose that the supply men shall run this Association. We have denied them the right to vote. The report, we believe, should be adopted by this meeting, because it brings to you relief that you require.

Mr. Akarman, of Worcester: A few words as to the fallacy of the argument of the gentleman from Camden. He said that if supplymen become associate members of the Association, we will lose control of the affairs of the Association, by reason of their being made active representatives of the Association. If my understanding is correct, that same thing could apply now. There is no reason why a supplyman cannot come here as the accredited representative of a street railway company. I know, as a matter of fact, that there are supplymen here in this hall who have a right to vote and to participate in our deliberations, coming here as the representatives of street railway companies. The intention of the committee, as I understand it, being one of its members, was not to make it a condition of the subscription that the supplymen should become members of the Association. We owe a great deal to them. Its inception was brought about by them. It began at Boston through the efforts of Walter A. Jones, Mr. Brill, and one or two other supplymen, who had been about the country and were well acquainted with the railway men, and suggested the idea of forming this association. I have always felt that we treated the supplymen very shabbily. The committee had in mind, as far as I could see, and in the discussion which was had, that the Convention last year had practically passed upon this matter.

Mr. Harrison: We certainly do not want the supplymen to pay our debts and run this Convention. We do not intend that they shall do that, but as long as they attend our gatherings and we depend upon them for the most interesting feature of the convention and receive a thousand dollars from their Montreal exhibit to help us along, the committee thinks they should in some way be connected with us. We believe that the adoption of the report will give the Association the revenue it so badly needs to enlarge its field and scope. The National Electric Light Association has associate members, and raises a large revenue. The supply men do not annoy them. I have been a member of the Institution of Mining Engineers for many years, with a very large membership, of which the greater part are associate members. We can therefore follow the successful experience of kindred organizations.

As to the plea that we need secret meetings, I would state that I have not attended many meetings, but have attended enough to know that there is no discussion, action or paper presented to this Convention that does not find its way into the technical press, accompanying a general outline of all the business we transact. I do not believe there is any necessity for secret sessions of this Association. If there should be great necessity at times for executive session, we have that privilege under the constitution and by-laws; but that is no reason for excluding the supplymen from membership in the Association for so unimportant a reason.

Mr. Green, of St. Louis: I am sorry that questions of this kind should come into this Association. As to the supply men, there would not be a corporal's guard in this Convention but for them. They spend their money and are the life and soul of this Convention. You find them putting exhibits in the hall at enormous expense, to show you the latest developments in the street railway business, and it does not cost the members a cent. They supply our material, and build our roads, and are willing to take our bonds, and why in the name of common sense do we not want them with us? They have attended every Convention since the beginning. We are not calling upon them to pay our debt. That will be wiped out before these gentlemen are to be taken in. The supply men started the Convention, if the facts were known. What would there be in the Victoria Rink if the supply men were not here? They come ahead of the meeting and stay after we are gone, and to their credit be it said they pay their bills all the time. If you exclude these gentlemen, who are the mainspring to this Convention, good-by to the American Street Railway Association.

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* Read at the Convention of the American Street Railway Association, Montreal, Oct. 15-18, 1895.

Mr. Seely, of New York: I will give $100, without any conditions. I build railways, and I sell them; you all do it; you are all supply men. I am with the supply men, or I am against them, according to circumstances. When Mr. Thompson spoke, I was confident he was not aware of the condition of affairs in this Association. I am sure he has the greatest respect for all supply men, but he objects and so do a great many of the members of the Association to being forced to subscribe to a fund upon conditions. The report was tabled by a vote of 87 to 11.

After further discussion, it was decided to invite the representatives of companies to volunteer subscriptions, and the following amounts were pledged: Union Depot Railway Company, St. Louis, $100; Lindell Railway Company, St. Louis, $100; Missouri Railway Company, St. Louis, $100; St. Louis Railway Company, St. Louis, $100; Citizens' Railway Company, St. Louis, $100; Southern Railway Company, St. Louis, $100; Cass Avenue & Fair Grounds Railway Company, St. Louis, $100; Chicago City Railway Company, $100; Covington & Cincinnati Street Railway Company, $100; Camden, Gloucester & Woodbury Street Railway Co., $100; Atlanta Consolidated Street Railway Company, $100; Lock Haven Street Railway Company, Lock Haven, Pa., $100; Williamsport Passenger Railway Company, $100; West End Railway Company, Boston, $100; Twin City Railway Company, St. Paul, $100; Twin City Railway Company, Minneapolis, $100; Wilkes Barre & Wyoming Valley Traction Company, $100; Reading Traction Company, $100; Cleveland City Railway Company, $100; Louisville City Railway Company, $100; Lehigh Traction Company, Hazleton, Pa., $100; North Chicago City Railway Company, $100; Bridgeport Traction Company, $50; Newark & South Orange Railway Company, $50; New Brunswick Traction Company, $50; Winchester Avenue Railway Company, New Haven, $50; Manchester Street Railway Company, $50; Montreal Street Railway Company, $50; Ottawa Electric Railway Company, $50; Columbus Street Railway Company, $50; Brooklyn City & Newtown Railway Company, $50; Consolidated Street Railway Company, Worcester, $50; Citizens' Street Railway Company, Indianapolis, $50; Buffalo Railway Company, $50; Hartford Street Railway Company, $50; Union Railway Company, Providence, $50; Terre Haute Electric Railway Company, $50; Troy City Railway Company, $50; Globe Street Railway Company, Fall River, $50; Omaha Street Railway Company, $50; Paterson Railway Company, $50; Scranton Traction Company, $50; Toronto Railway Company, $50; Taunton Street Railway Company, $25; New Haven Street Railway Company, $25; St. Joseph & Benton Harbor Electric Railway & Light Company, $25; Akron Street Railway Company, $25; Wayne & Fifth Street Railway Company, Detroit, $25; Consumers' Electric Light & Street Railway Company, Tampa, Fla., $25; Des Moines City Railway Company, $25.

The subscriptions received aggregated $3,425. On motion of Mr. Scullin, companies were allowed to subscribe again and the following additional amounts were pledged: St. Louis Railway companies, first named, $100; Union Depot Railway Company, St. Louis, $100; Chicago City Railway Company, $100; Twin City Railway Company, St. Paul, $100; Twin City Railway Company, Minneapolis, $100; Camden, Gloucester & Woodbury Railway Company, $50; Montreal Street Railway Company, $50; Atlanta Consolidated Street Railway Company, $50; St. Louis Railway Company, $50; Milwaukee Street Railway Company, $50.

Mr. C. B. Fairchild pledged $50 for the West Chicago Street Railway Company and Mr. John A. Seely announced the following subscriptions: H. M. Littell, $100; J. A. Bailey, $100; J. Willard Morgan, $25; New Bedford Street Railway Company, $25. The subscriptions aggregated $4,475.

Mr. Harrison made the following remarks: "As chairman of the committee appointed to devise ways and means, I desire to say that he consistently and persistently followed what he deemed to be a proper course of duty. The Convention has made a decision on that question, and the chairman of the committee accepts the decision with perfect good feeling for every member of the Association, and I have the right to say that I express the sentiments of all the committee. I have not had time nor opportunity to confer with it, and in the absence of the gentlemen I will state to the Convention that they accept this decision as settling that matter, and that we congratulate the Association upon raising the money which will result in wiping out the debt."

Proposed New York Ordinances.

The law committee of the New York Common Council recently gave a hearing on several proposed street railway ordinances. One of these provided that cars should not pass each other within 50 feet of a school; another required cars to stop at the first instead of the second crossing when passing school-houses, and a third required companies to refund fares or issue tickets in the case of a block on the road. Several of the companies made protests against the adoption of these measures.

Comments and Views of Contemporaries.

An Electrical Experiment.—The New, New Haven & Hartford Railway is about to make its first experiment with electricity in this State on its New Canaan branch, and it will be an important step, inasmuch as upon its success will depend the extension of the electrical plants. Electricity is really not an experiment with the Consolidated, as the company has tried it at Nantasket, and with satisfactory results. The conditions are very likely widely different at New Canaan, and before electricity can be applied on the lines where the heavy freight and passenger traffic is conducted there will need to be many changes in the generation of power and construction of rolling stock. It appears to be the coming motive power, and taking the rapid development of the trolley systems in eight years from nothing to general use, there is good ground for expecting the fruition of the hopes of the electricians in a comparatively short time.—*New London, Conn., Day.*

Damage Suits.—Suing for damages is very much of a lottery. One applicant may have the luck all his way, like the young man who, having recovered $20,000 from a railway company for injuries sustained on its line, has just secured a further verdict for $295 for nurses' bills, while another may be relentlessly harried by perverse fate. A pathetic instance of ill luck in an enterprise of this kind comes from a town in Massachusetts. A citizen while walking down the main street came in contact with a telephone wire, and received a shock which caused him to hop briskly off the sidewalk. The wire had been blown down by a gale of wind, and had fallen across the trolley wire of the electric street railway company. By the time the man reached home his brain was busy with thoughts of redress. Next day he sued the telephone company that owned the wire; the following day he sued the street railway company across whose trolley the wire fell, and the third day he sued the man to whose building the wire was attached. But, alas! when the jury in the first case came in it decided that the accident was the act of Providence. The unfortunate man is still full of fight, but he is at a loss to know whom to sue next.—*New York Times.*

Steam Must Go.—The age of steam is closing—if George Westinghouse, Jr., of Pittsburg, is correct in his conclusions. He tells the *Dispatch* of that city it is perfectly feasible to run the heaviest stationary and locomotive engines by gas derived directly from coal, without the use of steam, and that he proposes to undertake the development of that plan. The main object contemplated is to apply the power of great gas engines directly to the generation of electricity. The main obstacle to the general use of electricity as a power of all kinds of work for which steam engines are now used, is the enormous loss of power from using the heat of burning coal to generate steam, applying this to driving a steam engine, and the power thus produced to the generation of the electric current. Mr. Westinghouse asserts that, by obtaining gas from the coal and using it to drive a gas engine, from six to ten times as much power can be obtained from coal as is now obtained through the steam engine. The saving in the cost of fuel will be enormous, and will make it cheaper to run all railways by electricity than by steam locomotives. We are inclined to put much faith in these statements because Mr. Westinghouse is a practical man, not a visionary theorist. His life has been spent in the building of machinery, and he knows what he is talking about. And, if he be correct in his statements, it means that the age of steam will pass, and the electric age begin with the twentieth century.—*Toledo Blade.*

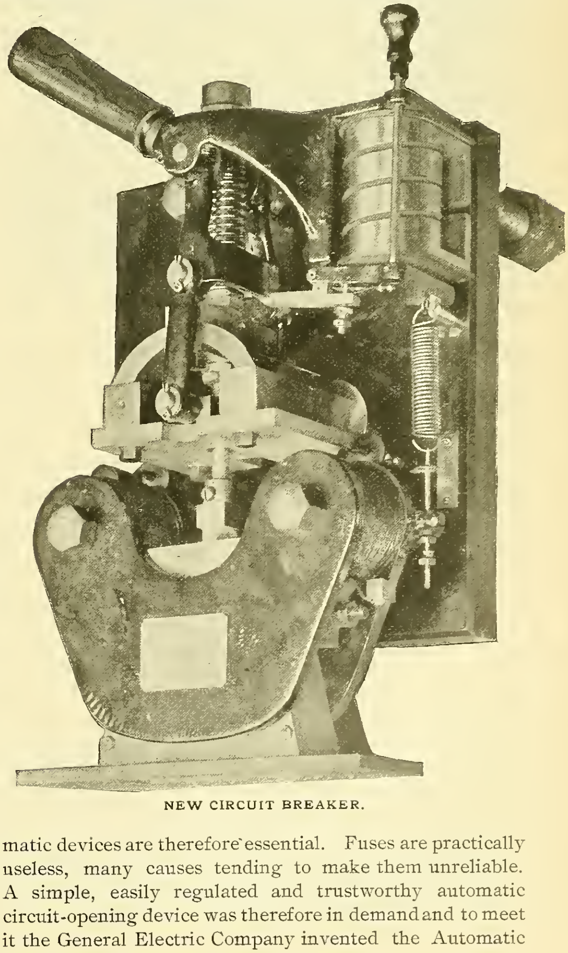
Trolley and Steam.—Owing to the growing competition of trolley roads with steam lines in New England, all indications of the policy of the powerful steam companies with respect to such competition become interesting. It was announced a few days ago that the New Haven Company had obtained control of the Stamford trolley system, and the remark has been made that this purchase interposed an obstacle sufficient to prevent the construction of a trolley parallel, composed of several successive lines, between New Haven and this city. While it may be that the buyers had this purpose in mind, it appears that the New Haven company will utilize its new trolley property in another way. The company operates a branch road, eight miles long, from Stamford to New Canaan. It will now operate this branch road and the Stamford trolley lines by electric power, using the existing trolley power plant for both systems. The motors on the branch road will be like those used so successfully on the Nantasket branch, where the traffic was increased by about 300 per cent. during the past season. The change is in the direction of economy, for the cost of operating the New Canaan branch will be reduced. This purchase and utilization of an adjacent trolley system may suggest similar action at some other places and other roads.—*New York Times.*

Warning Signals.—A more efficient trolley-car warning signal that that generally used is badly needed. A letter from an electrical correspondent in Dresden, mentioning, among other improvements on American practice in street-railway work, that in Dresden the motorman gives warning of the approach of the car by sounding a bell, placed at the top of the brake-lever handle, by merely moving his hand up and down the handle, has been discussed with much interest in Pittsburg, the press of which has readily joined in condemning the ineffective gongs at present used on electric lines in most cities. The motorman of the city are unanimous in denouncing the gong, and asking for a more practicable signal. A strange fact has been revealed by inquiry among the employees of the various lines. It is found that the continual pounding of the gong has such a peculiarly injurious effect upon the men that many of them are at present laid up from it. The symptoms exhibited have been so uniform and characteristic that the physicians speak of the new disease as "gongdolysis." If the complaint is half as hideous as the name, its victims are indeed to be pitied. It is said that three men on one Pittsburg line have been permanently disabled by ruptures of a peculiar form caused by the shock of the incessant pounding upon the gong with their heels. —*New York Times.*

Electricity as a Competitor of Steam.—The opening of the new trolley line from Frankford to Torresdale will mark another step in the competition between steam and electricity in this section. As the new electric line starts off with the fares to the suburban points considerably less than those charged on the New York branch of the Pennsylvania Railway, with which it competes, the natural consequence will be a series of material reductions by the latter. To the ordinary mortal, those who do not claim to possess the qualifications necessary to manage great railway systems, it seems odd that the steam lines keep up fares until they invite trolley competition and then reduce them. It would seem the policy of wisdom to offer very reasonable rates on every branch, and to thus keep investors diffident about building trolley lines. It is because railway rates are high that the trolley finds its opportunity. Cheap fares would be a decided blow at trolley projects, and the sooner the steam lines fight in practical style the building of trolley railways, instead of waiting until after they are built to cope with them, the better it will be for all steam roads. The management of the lines entering this city have not shown an ability to meet trolley competition in a successful manner, and it is this oversight, if not stupidity, which has given trolley building its great impetus.—*Philadelphia Item.*

The "K" Automatic Circuit-Breaker.

With the modern practice of employing a few large and costly generating units in railway power stations arose the necessity of employing certain special devices to control and at the same time to protect the apparatus from injury from outside accident. Short circuits, grounding of lines or other troubles result in an enormous increase of current, which, if the circuits remained closed would cause serious damage to both conductors and insulation, if not total destruction. Such accidents give no warning, and automatic devices are therefore essential. Fuses are practically useless, many causes tending to make them unreliable. A simple, easily regulated and trustworthy automatic circuit-opening device was therefore in demand and to meet it the General Electric Company invented the Automatic


NEW CIRCUIT BREAKER.

circuit-breaker, which has become an essential part of all modern station equipment.

This circuit-breaker is now constructed to meet almost every possible variation of current from 150 to 3,000 amperes.

The principal of its operation is as follows :

The total current of the generator or feeder passes through the large vertical magnet and across a bridge of flexible copper strips, which normally is locked in contact with the conducting studs of the breaker. The magnet acts upon a lever to trip this lock and a heavy spiral spring pulls away the bridge when freed by the action of the magnet.

Opposed to the armature lever of the magnet is a tension spring which is carefully graduated by test and can be so set as to allow the armature to trip only at a definite magnet pull ; this pull depends directly on the amperes in the circuit and the scale reading of the spring is consequently marked in amperes. The tripping tension can be varied in a given instrument through a considerable range, and thus the breaker be adapted to various requirements.

When a current of several hundred or several thousand amperes at 600 volts is broken, a very considerable amount of heat energy results. In most circuit-breakers this energy expends itself on the main or on supplementary carbon contacts which must be frequently replaced, by reason of the fusing or burning. In the "K," however, the main or bridge contacts are shunted by the windings of a pair of small magnets, the poles of which enclose a chute containing supplementary contact points; these supplementary contacts break the circuit just after the main contacts have separated.

When the latch trips, the main bridge drops, forcing the whole current to pass through the small magnets. This results in the creation of an intense magnetic field between their poles. In this field the supplementary contacts then open, the magnetism instantly blowing out the resulting arc without damage to the contacts themselves.

This use of a magnetic field for preventing destructive arcing is an invention of Prof. Elihu Thomson and has been applied by the General Electric Company, which controls the method, to lightning arresters, fuse boxes and car controllers as well as to circuit-breakers.

The great success of the thousands of devices based on the magnetic blow-out principle demonstrates that the General Electric Company has secured, perhaps, the most practical means of safely breaking heavy currents.

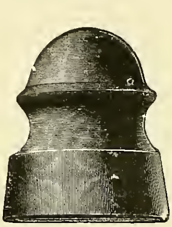
Franklin Leonard Pope.

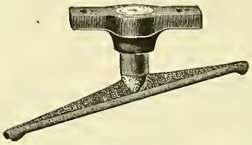
The friends of Mr. Franklin L. Pope were greatly startled, last Monday, by the announcement of his death from an electric shock, accidentally received, at his home in Great Barrington, Mass.

It appears that there was located in the cellar of Mr. Pope's residence a converter, from which current was used for lighting the house and for experimental purposes. The primary wires of the local electric lighting system, therefore, which carry a pressure of 2,100 volts, were led into the cellar. On Sunday evening, Oct. 13, some trouble occurred which Mr. Pope went down to the cellar to remedy. After a few moments the family upstairs heard a heavy fall below, and upon investigation found Mr. Pope lying lifeless beside the transformer. Mr. Pope was prominently identified with electrical work in many branches, and was widely known as a man of the highest type, morally and intellectually. His death will be keenly felt by hosts of friends in all professions. He was in his 55th year, and leaves a widow, two daughters and a son.

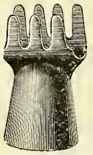
Medbery Exhibit at Montreal.

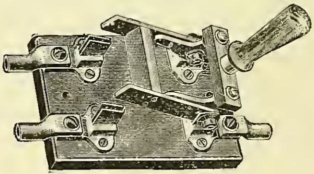
The exhibit of the Fiberite Company, of Mechanicville, N. Y., at the Montreal Convention of the American Street Railway Association was examined with interest by the managers of roads and practical men generally. It comprised a complete line of Medbery material, which is used by many prominent roads in the United States and in Canada. All the systems in Montreal are equipped with the Medbery material. Some of the principal features in the exhibit are illustrated herewith. The standard and W. E. types of straight-line hangers are so thoroughly protected that it would seem that a line equipped with such material should last indefinitely. Similar styles of hangers are made for both single and double pull-offs. The globe strain insulator has been tested to remarkably high degrees for both strength and insulation. The report of Prof. Morton, of Stevens Institute, showed a breaking strain of 7,600 pounds and a resistance of 350,000 megohms. This insulator is made in three sizes. The Brooklyn strain insulators are used where unusual conditions are encountered, such as at ends of lines and where a large number of wires are connected from one point. The feeder hangers of Medbery make have become popular for all kinds of difficult construction.

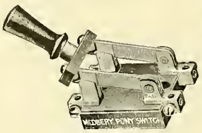

FEED WIRE INSULATOR.


CAR-HOUSE INSULATOR.

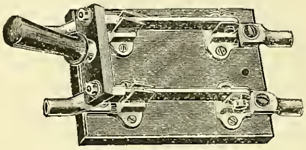
GLOBE STRAIN INSULATOR.


FEED-WIRE INSULATOR.


QUICK BREAK SWITCH.



PONY SWITCH.


KNIFE SWITCH.

The great strength and insulating qualities of these devices cover all points needed for such service.

The company has produced a trolley wheel which has met with great success in actual service.

The switches and overhead frogs, which are inventions of one of the most practical men in the business, were exhibited. As there is no depression the trolley wheel can follow the switches at the same speed as on the main trolley wire. The insulated adjustable crossover was originally designed by this company for the North and West Chicago roads. It has met all the requirements needed.

The company is making a very high grade of station and pony switches, in sizes from 15 to 600 amperes capacity.

The Medbery water-proof sockets are also popular on account of their great strength and high insulating and weather-proof qualities.

For illuminated signs, cold storage rooms and exposed places generally the water-proof sockets are giving the best of satisfaction.

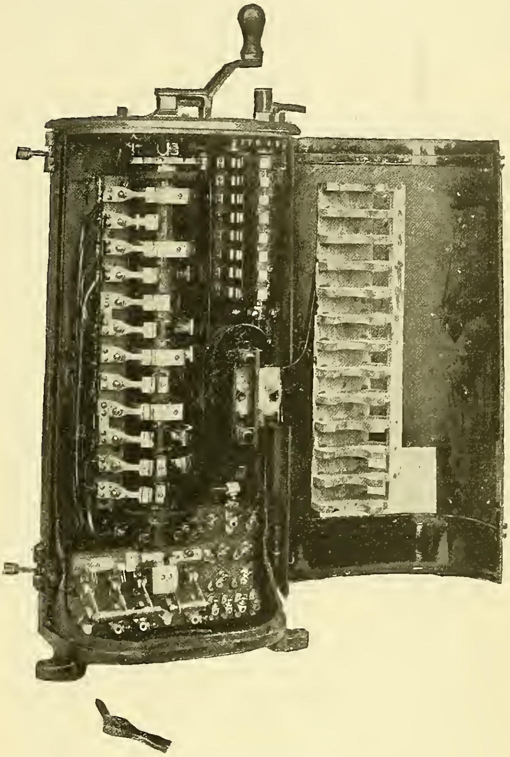
Operating Motors Under Difficulties.

The photograph from which the accompanying cut was reproduced was taken at Middletown, Conn., last Spring. It illustrates the conditions under which electric motor cars are sometimes operated. The track which the car shown in the engraving traversed was part of the main line in the system. It was covered with water to a depth of a foot or more. For two days all the cars of the Middletown Street Railway Company, Supt. Goss states, made their regular time through this water, some of them hauling trailers, without the loss of a fuse or any damage to the motors. The motors are G. E.-800 machines, worked in connection with K 2 controllers.

FLOODED TRACKS IN MIDDLETOWN.

New Controller.

The "K 2" Controller of the General Electric Company is a modification of the familiar and successful "K" controller, and is adapted to the higher speed motors which are now required for street railway service. The modifications consist chiefly in the introduction of an additional resistance point, in order to afford a smoother acceleration both in the series and in the multiple positions. A cast cylinder has been adopted for the controlling mechanism in place of the original cylinder used with the "K" type, as the newer form presents certain advantages in wearing qualities. The "K 2" case is very slightly larger than that of the "K" form, but most of the working parts of the two controllers are identical. Several thousand of the "K 2" controllers are now in use, and their success has been fully as marked as the type of which it is a modification.



"K2" CONTROLLER.

Mr. Edison on Electric Traction.

Prof W. D. Marks, of Philadelphia, has recently made public some views expressed by Mr. Edison in a recent conversation. In reference to electric traction the latter said that while the overhead system was undoubtedly the best and cheapest method yet reached, he believed that it would be supplemented by a system in which the conductors would be underground. While this plan would require a large original investment it would, he thought, prove more satisfactory in operation and require fewer repairs.

FINANCIAL NOTES.

SCHENECTADY, N. Y.—The receiver for the Schenectady Railway Company reports the following: Gross earnings, $27,551; operating expenses, $26,837; fixed charges, $758; net deficit, $44; total deficit, $21,312.

BRIDGEPORT TRACTION COMPANY'S EARNINGS.—The gross earnings of the Bridgeport Traction Company for the first nine months of 1895 were $228,439, against $93,281 last year. Net earnings were $112,681 or $37,681 more than the interest charges for the entire year.

OTTAWA.—In the application for a receiver of the Ottawa Electric Street Railway, made by the Metropolitan Trust Company, of New York, trustee of the bond mortgage of the road, Judge Showalter directed that a receiver be appointed. The attorneys for the respective parties will agree on the receiver and report his name to the court. The electric company ceased operations last Spring, and has been sold for taxes since that time. Its franchises were revoked by the City Council of Ottawa.

KANSAS CITY STREET RAILWAY EARNINGS.—Earnings of the Metropolitan Street Railway system of Kansas City for June, July and August, since organization, show as follows:

	June.	July.	August.
Gross earnings	$155,002	$163,123	$164,153
Operating expenses	89,954	91,322	89,362
Net	65,048	71,800	74,791

The Metropolitan Company's stock issue is $5,586,800 and $7,505,900 bonds are outstanding.

WEST END RAILWAY (BOSTON).—It is believed that the West End must put away more than $1,000,000 this year in the improvement of its property over and above the dividends paid, and it will be interesting to see how the figures will be arranged in the forthcoming annual report. Last year the company reduced its surplus by charging off $180,000 as discount on bonds, while $272,807 of track improvements for that and previous years was put into the expense account, and the dividend period was so changed that 7½ per cent. on the common stock was paid out of the year's earnings, while the stock was nominally paying 6 per cent. per annum. This year there is no change in the dividend period, no discount on bonds to charge off, and track repairs will have to draw on the future to absorb as much money as last year. But the company has expended about $120,000 more than usual in replacing old cars, which will, of course, be charged to expense; the Albany Street power-house has taken about $90,000 this year in expenditures upon its enlargement and a similar amount has been expended for putting feed wires underground, all of which, we understand, will be charged to expense. These items, together with $60,000 appropriated for heating cars and $60,000 appropriated for increasing the Dorchester feed wires, or a total of $420,000, can be put into expense, or in all about $700,000, provided as large extraordinary track repairs are charged to expense as last year, but for this latter item the future must be drawn upon as the money to this amount has not been expended for track renewals this year. With all this charged off the company will still have a liberal surplus, a part of which can be accounted for as extraordinary earnings due to the conventions of the past year. But the cash in the bank cannot be reduced and ought to show nearer $2,000,000 than $1,000,000 at the close of the year.

NEW INCORPORATIONS.

ARCHIBALD, PA.—The Archibald Electric Street Railway Company has been organized to build a street railway in Archibald, by James Kane, Winton, Pa.; Edward Munley and Michael J. Moran, Archibald, Pa. Capital stock $30,000.

ROCHESTER, N. Y.—The Irondequoit & Lake Shore Electric Railway Company has been formed to build and operate an electric street railway. Among those interested are E. O. McNair, Warsaw, N. Y.; A. L. Johnson, J. A. Tom, and George Wilson, Rochester, N. Y. Capital stock $100,000.

CHICAGO, ILL.—The Chicago Electric Street Railway Company, capital stock $5,000,000, has been organized for the purpose of constructing, equipping and operating street railways and subways in the city of Chicago. The promoters are Sherman D. Parnia, John Parrott and O. W. Larson.

CORTLAND, N. Y.—The Croton Valley Electric Railway Company has been incorporated to build and operate a street railway four miles long in Westchester County. The promoters are John McNally, F. A. Canney, C. J. Ryan, Jr., and Timothy Burke, all from Croton-on-Hudson, N. Y. Capital stock $20,000.

DAVENPORT, IOWA.—The Munson Electric Conduit Company, capital stock $10,000,000, has been formed to manufacture, buy, sell and do a general business in electrical goods and appliances, and to construct electric railways. Those interested are John H. Munson, James E. Merritt and William F. Robert.

KANSAS CITY, KAN.—The Kansas City & Leavenworth Railway Company has been formed to maintain a double track standard gauge railway either by steam or electricity. The promoters are W. A. Bunker, Arthur Johnson, H. A. Keefer, C. F. Hutchings, Kansas City, Kan., and James Stone, Jr., Leavenworth, Kan. Capital stock $500,000.

WASHINGTON, PA.—The Washington & Canonsburg Railway Company has been chartered to construct a line of seven miles, from Washington to Canonsburg, Washington County. The capital is $75,000, and the directors are A. Kennedy, of Allegheny; Francis J. Forrauer, Thomas B. Hutchinson, L. H. Matthews, William Beall and Marshall H. Reno.

DAVENPORT, IA.—The Munson Electric Conduit Company of Davenport, Ia., with an authorized capital stock of $10,000,000, was recently incorporated under the Iowa laws. The concern will do a business of building and equipping electric railways and handling all sorts of electrical supplies. John H. Munson, James E. Merritt and Wm. F. Roberts are the incorporators.

BRADLEY BEACH, N. J.—The Asbury Park, Bradley Beach, Belmar & Spring Lake Street Railway Company has been formed to construct, maintain and operate a street railway and to construct and operate motors, cables, etc. The promoters are Henry C. King, New York City; Alex. Bogey, Brooklyn; N. E. Buchanan, John Hubbard, Asbury Park, N. J., and Charles H. Seaman, Bradley Beach, N. J. Capital stock $75,000.

MONROE, MICH.—The Monroe Electric Railway Company has been incorporated. The capital stock is $50,000, and the company proposes to build a street railway from the east to the west city limits with a view of extending it to the village of Dundee, 15 miles west. The incorporators are E. C. Rauch, A. B. Bragdon, F. G. Strong, Fred. H. Humphrey and W. H. Cowles, of Monroe; George M. Jewett, of New York; George M. Stearns, of Chelsea, Mass., and L. E. Walkins, of Boston. The following officers were agreed upon: President and manager, W. H. Cowles; secretary, F. G. Strong; treasurer, L. E. Walkins.

DEDHAM, MASS.—The Norfolk Central Street Railway Company has been organized. The capital stock is $75,000. Those interested in the company are: Thomas T. Robinson, John R. Bullard, Henry C. Delano, Dr. John W. Chase, Ferdinand F. Favor, Artemas Raymond, Hugh H. McQuillen, Judge Frederick D. Ely, Henry D. Humphrey, Erastus Worthington, Jr., Richard M. Jennings and T. T. Robinson, trustee, all of Dedham; Francis Sloane, of Norwood; A. R. Whittier, of Boston; Walter E. Geer, of Hyde Park, and Charles R. Stanwood, of Highlandville. The board of directors chosen is as follows: Hon. John R. Bullard, Thomas T. Robinson, Dr. John W. Chase, Henry C. Delano, Ferdinand F. Favor, all of Dedham; Francis Sloane, of Norwood, and A. R. Whittier, of Boston. The proposed railway is to commence at or near Memorial Hall, Dedham Centre, and extend through the towns of Dedham, Norwood and Walpole, to a point near the railway bridge in East Walpole, its southerly terminus, with a branch line to a point near the corner of Gay and High Streets, West Dedham, its westerly terminus. Its length will be 10 miles.

NEWS OF THE WEEK.

SCRANTON, PA.—The newly laid line on Franklin Avenue will be extended to Mulberry Street.

AKRON, O.—A company is being organized to construct an electric railway system from Akron to Massillon.

PITTSBURG, PA.—The Pittsburg & Lake Erie Railway is said to have disclaimed any intention of building an electric line to McKeesport.

ONEIDA, N. Y.—It is reported that the New York Central intends to construct an electric railway from Oneida to Sylvan Beach, on Oneida Lake.

HOLLISTON, MASS.—The Milford, Holliston & Framingham Electric Railway Company has applied for a franchise to construct an electric road.

CHESTER, PA.—Joseph H. Hinkson is interested in a trolley line that will probably be built along the river road from Lazaretto to Philadelphia.

NORWICH, CONN.—The project to build an electric railway between Norwich and New Jordan has been abandoned by the directors of the company.

NEW CASTLE, KY.—The enterprise is being agitated for an electric railway between New Castle and Eminence, Henry County. It will probably cost $40,000.

HUNTINGTON, IND.—The Huntington, Columbia City & Ligonier Railway Company proposes to construct electric lines in the three cities from which it takes its name.

SANDUSKY, O.—An electric road is proposed from Sandusky to Sevenmile-house. W. W. Graham, of Norwalk, and Chas. Rude, of Sandusky, are promoting the enterprise.

DETROIT, MICH.—The Detroit Railway managers expect to be able to add 20 more cars to their service, with a part of the new power-house in operation, in about a week.

NORTH EASTON, MASS.—The officials of the Boston & North Boston Street Railway Company have accepted the franchise granting permission to lay tracks in North Easton.

EAST ST. LOUIS, ILL.—The citizens residing near Cross Park have petitioned the management of the East St. Louis Electric Railway Company to extend its lines to that section.

MIDDLETOWN, MD.—The directors of the Fredericksburg & Middletown Electric Railway Company decided at a recent meeting to begin at once on the construction of their road.

EVERETT, IND.—A contract to manufacture and deliver 64,000 ties for the Everett Electric Railway will soon be let. There will be used sawed and hewn ties, and the contract will be open to all comers.

HAGERSTOWN, MD.—E. E. Sponseller, of Harrisburg, Pa.; J. Clarence Lane, of Hagerstown; Hon. G. M. Culk, of Shamokin, Pa., have organized a company to build a trolley line to Funkstown, Paynesboro and Penn Mar.

HARTFORD, CONN.—At a meeting of the Street Board, Albert W. Gilbert was re-engaged to attend to the city's interest in the new street railway extension, which embraces the line through New Britain Avenue to the city limits.

NEW HAVEN, CONN.—The Winchester Avenue Railway Company has recently received a new car, which is being fitted up for trolley parties, and is declared by critics to be the finest and strongest built car in New England.

URBANA, O.—The ordinance granting a franchise to build an electric railway between Urbana and Springfield, has been modified by the City Council. It is expected that W. H. Hanford & Co., the grantees, will accept the amended franchise.

BALTIMORE, MD.—Work has begun on the new power-house of the Baltimore, Middle River & Sparrows Point Electric Railway on the Eastern Avenue road. It is to be of brick and iron construction, 62 x 110 feet, the estimated cost being $7,000.

CHESTER, PA.—Work on the new plant of the Chester Electric Light & Power Company is progressing very favorably. The brick work upon the power station and boiler house is practically completed, and in a short time both buildings will be under roof.

BANGOR, ME.—At a meeting of the City Government, the petition of the Bangor, Orono & Oldtown Railway Company, for locating its railway on certain streets was referred to a special committee of the board, with the City Engineer and Alderman Grant, Porter and Glass as members.

HUDSON, N. Y.—The Columbia County Electric Railway Company has absorbed the Electric Light & Power Company and the Hudson Electric Railway Company, and will extend the trolley lines to the several towns surrounding Hudson, and greatly improve the street car service in that city.

LOGANSPORT, IND.—A new electric road is to be constructed connecting this city with Rochester and Burlington. The road will be about 35 miles long, and will pass through the best part of Fulton and Carroll counties. J. T. McNary is at the back of the new road and has interested several Eastern capitalists.

OWASSA, MICH.—J. Henry Edmonds, of Cape May, N. J., and Alexander Ralph, of Philadelphia, Pa., have been in the city perfecting plans for putting electrical equipment on the Owasso & Corunna Street Railway. They appeared before the Council and asked for further grants. A plant will probably soon be in operation, at an outlay of $30,000.

BUFFALO, N. Y.—The Buffalo, Gardenville & Ebenezer Railway Company has applied to the board of railway commissioners of the State of New York for permission to use a trolley system on its Majorie Street route. This route runs to the junction of the Union and Aurora plank roads at the town of West Seneca. Chas. R. DeFreest may be addressed.

IRONDEQUOIT, N. Y.—A surface railway from Forest Lawn in the town of Webster, Monroe County, to a point near the shore of Lake Ontario at Irondequoit, will be constructed by the Irondequoit & Lake Shore Railway Company. The directors are A. J. Johnson, Joseph C. Tone, Joseph A. Johnson, Frank W. Ellwood and Edward L. Ellwanger, of Rochester; E. O. McNair and David W. McNair, of Warsaw.

PAXTON, ILL.—The Danville & Paxton Electric Railway is a project which is receiving the attention of capitalists in this city, and a committee has been appointed to secure 12 miles right of way. The citizens are asked to purchase $20,000 of the capital stock of the railway. Eastern capitalists are pledged to take the bonds at 90 cents on the dollar. The cost of building the 43 miles of road is estimated at $9,000 per mile, or $387,000. Articles of incorporation in the sum of $100,000 have already been filed.

BRAINTREE, MASS.—The creditors of the Braintree, Randolph & Holbrook Railway Company have not known what to do with the cars which they attached. The Quincy company, having leased the car-house from the Brockton Street Railway Company, informed the creditors that they could continue to have their attached property housed if they would pay $50 per day; otherwise the cars must be removed. The cars were taken out, and not being able to run the cars either upon the Brockton or Braintree rails, they are out in the field.

PHILADELPHIA, PA.—The work of tearing up the old cable conduits of the Philadelphia Traction Company, on Market Street, is progressing rapidly, gangs of men working at two different points between Delaware Avenue and Broad Street. It was not the intention of the Philadelphia Traction Company at first to do this work before next year, but the Union Traction Company thought it would be advisable to get it done as soon as possible, and the expectation now is to have new rails laid on all of Market Street before Winter sets in. The cable power station has been idle since the trolleys started running on Columbia Avenue some time ago.

CHICAGO, ILL.—What is claimed will be the longest interurban electric railway yet built in the United States is expected to be in operation by the 1st of January, 1896. It will run from Oshkosh, Wis., to Kaukauna, through Neenah, Appleton and Menasha, a total distance of 26 miles. Members of the Central Wisconsin Electric Railway Company, which is to build the line, have made final arrangements for the work, which will be begun within the next 10 days. Outside capitalists interested in the company are J. K. Tillotson and George H. Ketchum, of Toledo; M. B. Barr, of Cleveland, and C. E. Loss, of Chicago. This road will take in the entire manufacturing district of the Fox River Valley, and eventually may be extended to Green Bay.

TRADE NOTES.

EUGENE MUNSELL & CO., of New York, distributed at the Montreal convention a tasteful calendar, which maintains its utility as such until 1900. The advertising, too, is neatly done and not so overprominent as to destroy the usefulness of the folder. The October blotter of the calendar characterizes the convention days as red letter days by printing them in that color.

CHARLES N. WOOD, of Boston, dealer in second-hand machinery for electric railways, in which specialty he has been particularly successful both for the buyer and seller, attended the Montreal convention, stopping at the Queen's Hotel. Mr. Wood visited the convention also in the interests of the R. D. Nuttall Co., being its representative for New England and Eastern New York State.

MR. DAVID BENTLEY, a Philadelphia inventor, has applied for a patent on a fender. The construction is such that it will automatically shut off the current and apply the brake whenever the fender impinges on an obstruction. There are also side guards for the wheels, arranged to yield to a vertically upward stress. Mr. Bentley claims that a car equipped with this device will find it impossible to run over any one.

H. E. COLLINS & CO., of Pittsburg, Pa., the sole agents for the Cahall vertical water-tube boiler, made by the Aultman & Taylor Machinery Company, have placed Wm. R. Sattler & Co. in charge of their New York interests, with headquarters in the Havemeyer Building. Mr. Sattler is well known as an engineer, and was at one time at the Brooklyn Navy Yard in that capacity. The other member of the firm, Mr. Geo. C. Tewksbury, has been a very successful salesman in general mill machinery, and is well known throughout New England. The interests of H. E. Collins & Co. will be well looked after in this locality.

CAR STRAPS AND BELL CORD.—J. E. Rhoads & Sons, Wilmington, Delaware, are manufacturing a superior bell and register cord for street cars. It is a rounded cord, cut from tannate leather, and has great pliability and tensile strength. They have sold tens of thousands of feet to large traction companies. The Rhoads' factory also turns out many handsome styles of hand straps for street cars, and can make to order almost any style of strap desired. The firm has a new device for fastening these straps to replace the double and riveted joint, which is strong and ornamental. The Rhoads Volta dynamo belt is a brand of superior pliability, durability and adhesiveness.

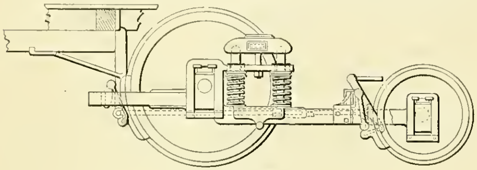
THE BUFFALO FORGE COMPANY, of Buffalo, N. Y., is now supplying several carloads of fans, engines and heaters for the heating and ventilation of the new shops in course of erection of the Southern Railway Company, at Knoxville, Tenn. All of the buildings at that point are equipped with the Buffalo fan system. There are used at Knoxville six fans—two 140-inch, three 130-inch and one 80-inch size, which have a total combined capacity of delivering 466,960 cubic feet of air per minute at one ounce pressure. The amount of lineal feet of pipe used in the heating surface if strung out on one continuous length, would be six miles. The large fans are in the main equipped with double-direct connected engines, entirely enclosed to keep the dust from the working parts. The Buffalo Forge Company has also received contracts for heating the Southern Railway Company's works at Atlanta, Ga.

THE WHITTINGHAM CAR HEATING COMPANY, of Baltimore, Md., has just issued a neat pamphlet describing and illustrating its new car heater, which is a radical departure from other types. The heater has wrought-iron pipes, which run under the seats the full length of the car, and the resistance coils are of Krupp wire, enclosed in insulating tubes, which are excellent heat conductors. An admirable distribution of heat is effected by this arrangement. A strong testimonial from the Second Avenue Traction Company, of Pittsburg, appears in the pamphlet, and a table, giving the results of a test of the heaters in January last, is presented. The facts certainly speak well for the efficiency of the heaters. The testimonial referred to states that during the blizzard of February last the floors of the cars heated by stoves were covered with snow and ice carried in by passengers, while those cars equipped with Whittingham heaters were damp, but wholly free from snow or ice.

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED OCT. 8, 1895.

547,471. DIFFERENTIAL BRAKE; Walter S. Adams, Philadelphia, Pa., assignor to John A. Brill, same place. Filed March 24, 1894. The combination, with a truck having large and small wheels, of a brake mechanism comprising shoes, beams and rods, a primary lever, and a supplemental lever having unequal arms fulcrumed to the primary lever, the rods connecting the unequal arms of the supplemental lever with the shoes of the large and small wheels respectively, whereby means are provided for applying a greater braking pressure to the large wheels than to the small wheels. (See Illustration.)



Electric Railway Gazette

NO. 547,471.—DIFFERENTIAL BRAKE.

547,472. CAR-TRUCK; Walter S. Adams, Philadelphia, Pa., assignor to John A. Brill, same place. Filed Oct. 9, 1894. The car-truck consists of the combination of an axle box frame having the yokes, with axle boxes located in and disconnected from the yokes and adapted to have lateral motion bodily thereon. The boxes having vertical webs or flanges on their front sides to bear against the yokes of the frame to limit the lateral movement of the boxes, recessed lugs on the rear sides of the boxes, coiled springs in the lugs bearing against the rear of the yokes, and leaf springs secured to the bottom of the boxes and bearing against the frame at each side of the yokes.

547,476. MOTOR-TRUCK; John A. Brill and Walter S. Adams, Philadelphia, Pa. Filed Jan. 3, 1894. This is a car-truck having an axle box frame with side bars included therein, axle box yokes in the side bars, a cross bar rigidly connecting the yokes, combined with a car body, and pivotal drawing device extending from points near the sides of said car body to the centre portion of said cross bar.

547,477. DRAFT APPARATUS FOR CARS; John A. Brill, Philadelphia, Pa. Filed May 6, 1895. The device consists in the combination, with a draw bar, of a draw head pivotally secured to the draw bar between its ends, and adapted to be vibrated downwardly thereon, and means on the inner end of the draw head for automatically locking the head and bar together.

547,482. WHEEL-FENDER; Herbert Claude, Annapolis, Md. Filed May 8, 1893. The combination with a car, of bars fixed to the truck frame only and extending forward to the end of the car, the frame secured to said bars and sliding vertically in guides upon the dashboard, a second frame pivoted to the front ends of said bars and projecting in front of the car, and a flexible apron connecting the upper member of the sliding frame with the parallel member of the pivoted frame.

547,522. CAR-FENDER; James W. McKinnon, New York, N. Y. Filed Dec. 21, 1894. The combination, with a car, hangers projected from the said car, having vertical openings therein, a shifting shaft, an endless chain operated from said shaft, a brake shaft and a shifting connection between the brake shaft and shifting shaft, of a fender held to slide in the said hangers, the rear portion of the said fender being connected with the said endless chain, and a cable connection between the endless chain and the rear of the fender back of its direct connection with the endless chain.

547,533. CAR-BRAKE; Walter S. Adams, Philadelphia, Pa. Filed April 25, 1894. In a brake mechanism, the combination with the brake shoes, means for pivotally supporting them, brake beams connecting said shoes in pairs, upright brake levers secured at their ends to one of said brake beams, brake rods secured to the opposing brake beam at one end and to the intermediate portion of the upright levers at their other ends, and means for vibrating the upright levers secured thereto above the connection of the brake rods.

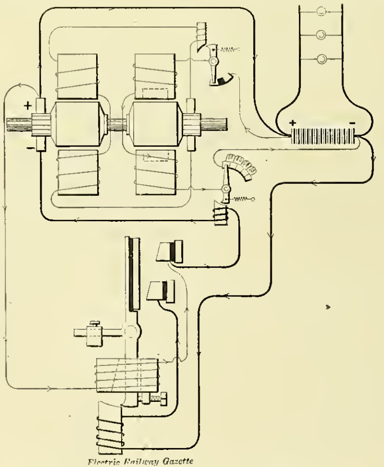
547,536. ELECTRIC CAR-LIGHTING APPARATUS; William Biddle, Brooklyn, N. Y. Filed Dec. 24, 1894. The combination of a dynamo, a storage battery, a compound switch having a polarized armature, and circuit-closing contacts, and an electromagnet the helix of which is in the main line circuit for moving the compound switch in one direction or the other, according to the direction of current set up in the armature of the dynamo to cause the current to flow in the proper direction to the secondary battery, a circuit-closing lever and contacts, and a helix in a circuit from the secondary battery for polarizing the armature of the compound switch, such circuit being broken by the lever when the current set up by the dynamo is the same or nearly the same as that of the secondary battery.

547,537. ELECTRIC CAR-LIGHTING; William Biddle and Harry E. Dey, Brooklyn, N. Y., assignors to said Biddle. Filed Jan. 9, 1895. This is a combination of an electric lighting apparatus, with a secondary battery and a lighting circuit, of a dynamo having two armatures and two sets of field magnets the helices of one set of field magnets being in circuit with the secondary battery, and the helices of the second set of field magnets being in a circuit from the brushes of the first armature, and the brushes of the second armature being in the main circuit to the secondary battery. (See Illustration.)

547,566. CAR-FENDER; Earl Sherwood, Honesdale, Pa., and George B. Parsons, Shawneetown, Ill. Filed July 13, 1895. The fender consists of an open rectangular guard frame having a hinged connection with the car and provided with a net stretched across and secured thereto, a rearwardly extending arm or catch affixed to the guard frame and projecting beneath the car platform, and a rectangular trip frame surrounding the guard frame and mounted to slide longitudinally in guiding eyes beneath the car platform, the rear car of the frame being adapted to engage with an arm or catch on the guard frame and the forward extremities of the side arms of the trip frame being deflected inwardly and connected by a flexible strap, all arranged for joint operation.

547,594. SWITCH-OPERATING DEVICE; Samuel Walters, Warren, Pa. Filed July 25, 1895. The device consists of a slotted sifter, pivoted between the rails, a switch tongue, and a rod for connecting the two, combined with two rods connected to opposite corners of the shifter, two pivoted arms to which the outer ends of the two rods are connected, a bracket having its inner end to catch in the slot in the shifter, and the spring secured to the outer end of the bracket.

547,707. STREET-CAR FENDER; Richard A. Breul, Bridgeport, Conn. Filed March 23, 1895. This is an improvement in car fenders, and consists of a forwardly projecting **U**-shape frame designed to be pivoted to a car, the frame having its forward bar inclined at a different angle to that of its side bars, the bearings or supports are secured to the under side of the forward bar, scrapers or levers pivoted in pairs to said forward bar and having overlapping portions, outwardly projecting arms or members, and inner curved arms, springs connecting the curved arms of each of said pairs, guide-arms secured to said forward bar and engaging projecting portions of said horizontal members.



Electric Railway Gazette

NO 547,537—ELECTRIC CAR LIGHTING.

547,628. CAR-FENDER; Frank B. Crooker, Fitchburg, Mass. Filed April 3, 1895. The fender is a telescopic frame consisting of a member fixedly supported from the car body, a second member slidable in the fixed member and provided at its front end with elastic cushions or springs, means for connecting the cushions or springs one with the other to prevent spreading, and means for operating the movable member of the frame to draw it beneath or project it from the car body.

547,728. SAFETY GUARD FOR CAR WHEELS; Henry H. Libbing and Charles P. Harris, San Francisco, Cal. Filed June 17, 1895. This is a safety guard for car wheels, and in combination, a scoop suspended from the car in front of the wheels, a yielding gate or fender suspended from the car in front of the scoop, a detachable bar on the car between the scoop and fender, and hooked rods extending respectively from the scoop and fender, to the detachable bar.

Electric Railway Gazette.

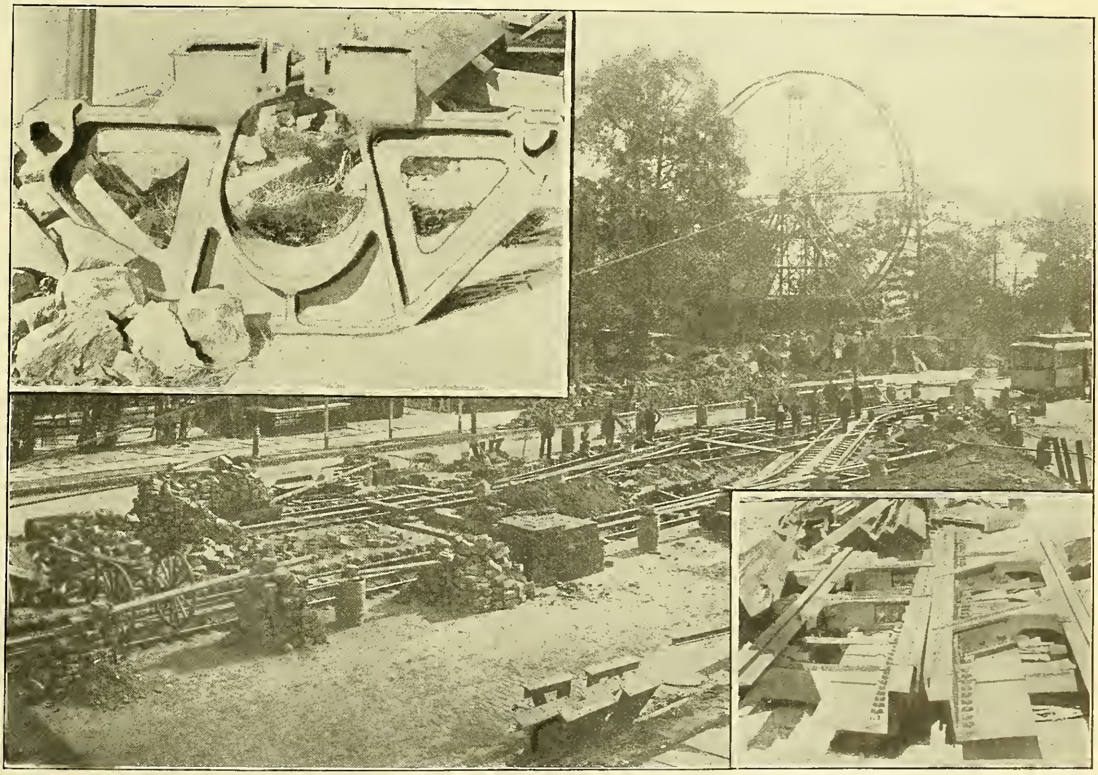
Vol. XIII. NEW YORK, OCTOBER 26, 1895. No. 17.

Third Avenue Company's Electric Conduit Railway in New York.

The fact that the Third Avenue Railway Company, of New York, is now engaged in building a section of electric conduit railway has already been noted. It was decided to install half a mile of road on Amsterdam Avenue beginning at 185th Street. The line is to be constructed solely for experimental purposes. When it is finished it will be thoroughly tested in all respects and if the results are as satisfactory as anticipated a number of existing lines will be similarly equipped. It has been stated that if the operation of the experimental line proves satisfactory the cable will be abandoned on the 125th Street road and the electric conduit system will be substituted.

The system which is being installed is that of the Love Electric Traction Company, whose installation in Washington has proved successful in operation. Some changes in details, however, have been incorporated in the construction for the Third Avenue Company. The work is now being rapidly prosecuted. Most of the track has been completed, and only the work on the curves over which is shown in the illustration remains to be done. The view was taken on Amsterdam Avenue, at the terminus of the cable line. The station from which the roads will be operated will be situated on the west side of Amsterdam Avenue, near 185th Street, a little south of the terminus of the cable road. Ground has already been cleared for the structure. Its dimensions will be 150 by 100 feet. The station will have a capacity of 400 hp, and the two multitubular boilers for the plant, built by the Franklin Iron Works, of Troy, N. Y., are already on the ground.

The road is exceptionally well constructed. An eight-inch rail grooved weighing about 75 pounds to the yard is being used, and on all special work the slot rails are made of riveted iron bars, as shown in one of the small cuts. The yokes, as the illustration shows, are massive iron castings, which besides forming the conduit support the rails. An iron hand hole is cast in either side of the yoke. These yokes are placed about 12 feet apart, and the sheet iron sections of conduit are laid in between. The system is being installed without any electrical conductors. These will be inserted through the slots and placed in position by reaching through the hand holes. Major McNulty and A. G. Wheeler are engineering the work for the Love Traction Company.



ELECTRIC RAILWAY CONDUIT CONSTRUCTION ON AMSTERDAM AVENUE—TYPE OF YOKE—SLOT RAILS.

Deatto Conduit Railway System.

A new conduit system belonging to that class in which surface contacts with magnetic connecting devices are utilized, is illustrated in the accompanying cuts. The car carries a strip of iron *A*, nearly equal in length to the length of the car, Figs. 1 and 4. The strip is magnetized by electromagnets *M*, excited in multiple with the motor *E*. The suspension of the strip which is shown in detail in Fig. 4 is not rigid, but permits motion both vertically and longitudinally. The contact boxes are located in the ground between the rails, and the distance separating two successive boxes is slightly shorter than the length of the strip *A*, so that the latter is always resting upon at least one of the contacts.

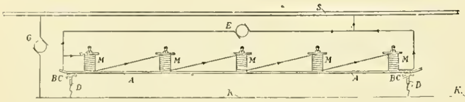


FIG. 1.

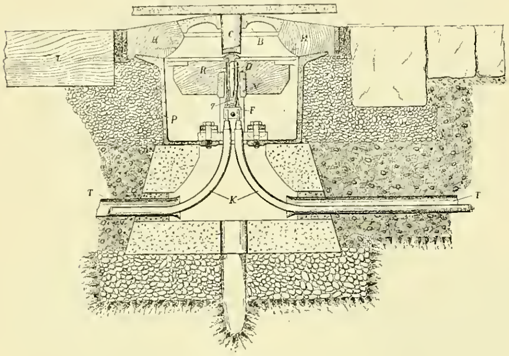


FIG. 2.

When the electromagnets are excited the upper iron piece *C*, Figs. 2 and 3, which is in contact with the strip *A*, is magnetized, and, in consequence, draws up the plunger *D*, which is placed in the interior of the contact box and which is immersed in a cup *R* partially filled with mercury and in circuit with the cable *K*. The contact is then established between *C* and *D*, and the current passes through the strip *A* to the motors. Mercury is used to insure a good contact and to partly balance the weight of the plunger *D*, so as to reduce the force of attraction necessary to raise it. The force ought to be just sufficient to allow the plunger *D* to fall of its own weight after it has been raised. To avoid the difficulty of residual magnetism which might cause *C* and *D* to adhere the contact surfacers of the two pieces are faced with non-magnetic metal.

The conductor *K* is cut into lengths equal to the distance between two successive contact boxes and the two extremities of each length are fastened at the bottom of the cups of mercury *B*. The conductor is placed in the interior of iron tubes *T*. This method of connection makes it very easy to localize faults and replace portions of damaged cable without tearing up the street.

The insulation of the cup *R* from the contact *B* is insured by pieces of wood, *H* and *V*, served with a moisture-proof compound. Trials on an experimental line for several months have demonstrated, it is claimed, that this insulation is ample, even when the ground is covered with mud or snow. As a rail return is used, insulation is absolutely necessary. It is still further reinforced by imbedding the contact boxes in asphalt. The boxes protrude only 3.5 centimetres above the ground, and as their surfaces are convex, ordinary vehicles can pass over them without difficulty.

The inventor estimates that the cost of installing this system will be from $3,400 to $5,000 per kilometre for a single track, but this appears to be much too little. The excitation of the electromagnet *M* in multiple with the motor appears defective, for it requires a special arrangement for starting. The weight of the electromagnets *M* and the contact bar is 200 kilos, and the electrical energy for exciting them is 250 watts. The system has been designed by A. Deatto, and the illustrations presented herewith are reproduced from *L'Eclairage Electrique*, of Paris.

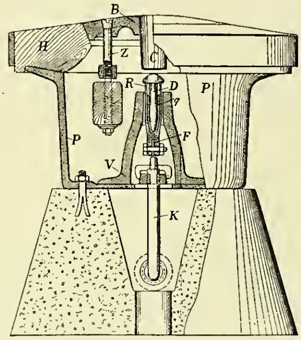


FIG. 3.

It might be asked why it is necessary to turn off the current from the attracting magnets *M*? There appears to be no reason why they could not be entirely independent of the motor circuit. If this plan was followed the contacts directly under the car would always be live and no starting devices would be necessary. A switch could be placed in the magnet circuit to cut the magnets out when the car was stored in the barn. But on the momentary line stops, live contacts under the car could offer no possible objections.

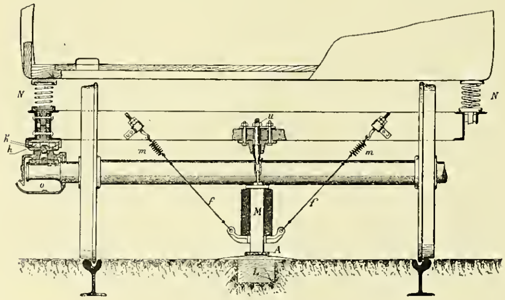
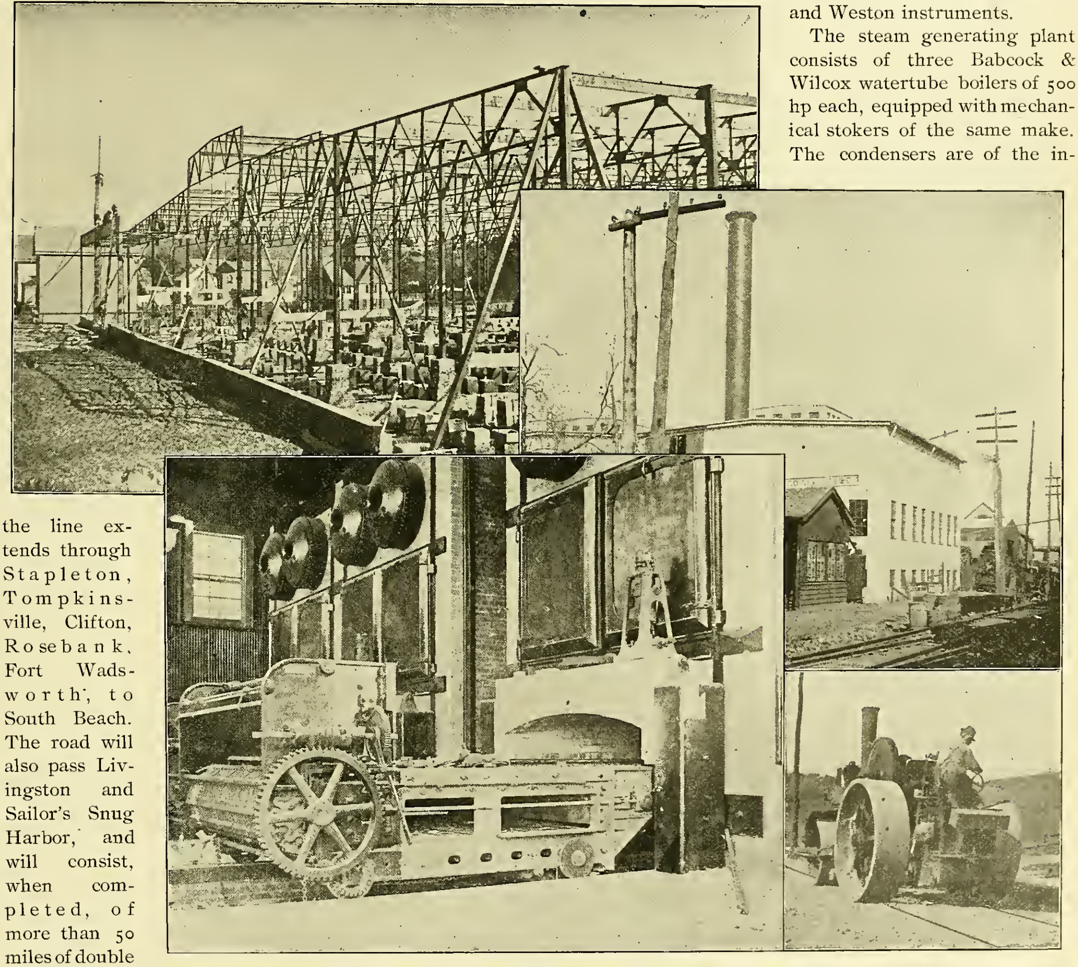


FIG. 4.

The Staten Island Electric Railway.

A suburban electric railway system, which, when completed, will be one of the largest and best equipped in the country, is now being constructed by the Staten Island Electric Railway Company, of New Brighton, S. I. In designing the system no expense was spared to make the railway, from power plant to road bed, complete and up to date in every particular.

The system extends from New Brighton to West Brighton, Port Richmond and St. George, where ferry connections to New York will be made. From St. George the line extends through Stapleton, Tompkinsville, Clifton, Rosebank, Fort Wadsworth, to South Beach. The road will also pass Livingston and Sailor's Snug Harbor, and will consist, when completed, of more than 50 miles of double track.



STATEN ISLAND ELECTRIC RAILWAY—POWER HOUSE—CAR HOUSE IN CONSTRUCTION—ROLLER USED IN MACADAMIZING—BOILER ROOM.

Twenty-five miles of double track have been laid, and the company expects to have the cars running in about three weeks.

The system extends through the most attractive suburban residence districts of Staten Island, and will provide direct rapid transit to numerous summer pleasure resorts along New York Bay and the Narrows.

The current for operating the system will be supplied from the power plant in New Brighton The building is located at the foot of Jersey Street on the Kills, and was constructed entirely of steel and iron by the Boston Bridge Company.

The structure measures 188 feet 6 inches by 60 feet 4 inches, but is so designed that it can be extended to double its present dimensions to provide for the increase in traffic in the future. The brick foundations for the machinery are separate from the building foundations, and rest on from six to twelve feet of concrete.

The present power equipment consists of two cross-compound condensing Corliss engines of the Allis type of 750 hp, each directly-connected to General Electric generators. The switchboard is of the panel type and equipped with General Electric and Weston instruments.

The steam generating plant consists of three Babcock & Wilcox watertube boilers of 500 hp each, equipped with mechanical stokers of the same make. The condensers are of the independent type manufactured by the E. P. Allis Company. Each engine is provided with a separate feed water heater and, in addition, the plant is equipped with an auxiliary Goubert heater of 2,000 hp.

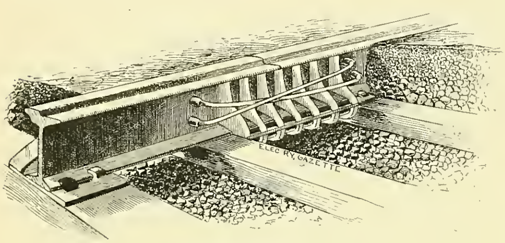
The feed pumps are of the Worthington duplex type, and feed water is taken from the city mains. There is also a well on the property from which the water supply may be taken in case of a failure of the supply from the city mains. The stack is of steel, 100 feet in height.

The system of piping is very complete in every respect, and is so arrayed that the possibility of a complete shutdown of the plant is practically eliminated. Steam from the boilers passes through eight-inch wrought iron pipes and copper bends of the same diameter to a twelve-inch main, and from the latter six-inch pipes extend to separators and thence to the engines.

In addition to the valves in the eight-inch pipes at the steam drums of the boilers, there are valves on the main between each boiler connection so that in case of necessity any boiler may be cut off from the main, or portions of the main itself may be closed.

The arrangement is such that either engine may take steam from any boiler, and the high pressure and low pressure cylinders may be run independent of each other.

The facilities for handling fuel are of the best. The plant is so located that coal can be brought directly to the power-house on boats on cars.



JOINT AND BOND.

The track construction throughout is of a most substantial character. The track is laid with 9-inch girder rails weighing 90 pounds to the yard which were supplied by the Johnson Company and the Cambria Iron Company. A large portion of the track is laid with 60-foot rails, which were rolled by the Cambria Iron Company.

The rails are laid on oak ties placed two feet between centres, and at every third tie braced tie plates are placed. The Wheeler rail joint is used on a large portion of the road and on the balance a 12-bolt fish plate is employed.

The rail joints are double bonded with the Chicago rail bond, manufactured by the Washburn & Moen Co., of Worcester, Mass. The cars were furnished by the J. G. Brill Company and are handsomely painted and decorated. The bodies of the closed cars are twenty feet in length.

They are painted in colors very similar to those of the cars used on the Broadway line of the Metropolitan Traction Company of New York. They are mounted on Peckham trucks, and are equipped with G. E. 800 motors. Sterling fare registers are employed, and all of the Winter cars are equipped with electric heaters made by the Consolidated Car Heating Company, of Albany. The interior finish of the cars is very attractive, and they are lighted by three groups of incandescent lamps mounted on handsome brass chandeliers.

The company has now under construction a fire-proof car-house, measuring 213 × 160 feet. The building is located at Jersey and Brook Streets, and consists of a steel frame with brick walls. All of the tracks in the building are provided with pits, which are of concrete, and will accommodate 100 cars. The repair shop occupies a part of the building, and will be equipped with the latest types of machine tools for making all necessary repairs.

The superintendent's office and waiting rooms for employees will be located in the building.

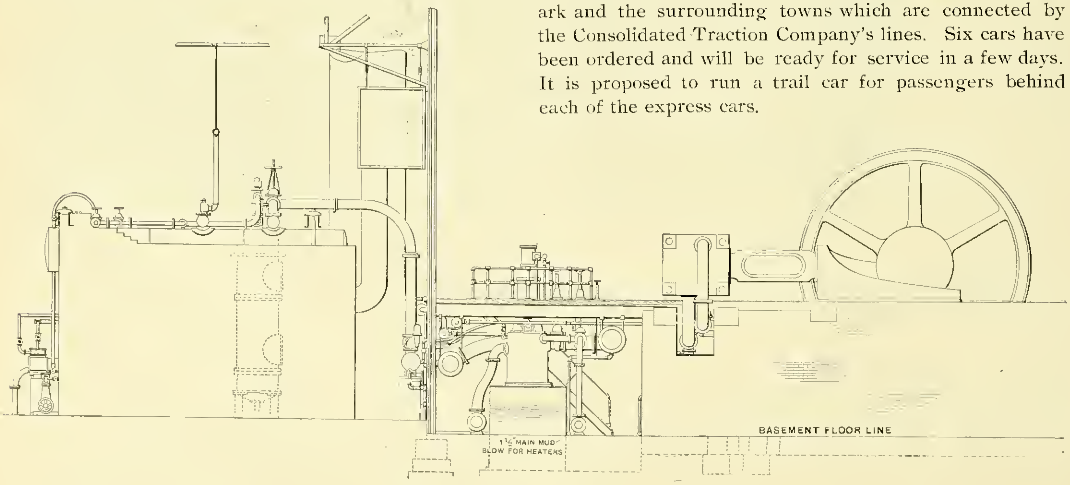
The entire system was designed by Sheaff & Jaastad, of Boston, Mass. The foundations for the machinery were built by the company, and the contractors for the piping system were Carman & Thompson, of Lewiston, Me.

Appeal in the Adams Suit.

The familiar case of the Adams Electric Railway Company against the Lindell Railway Company, of St. Louis, came up before the United States Circuit Court of Appeals in St. Paul last week. The suit is brought to recover for the alleged infringement of a patent for motor suspension granted to Wellington Adams and owned by the complainant. The appeal is from a decision of Judge Hallett in favor of the defendant. The suit is defended by the General Electric Company.

A Trolley Express Line.

The United States Express Company, it is stated, is preparing to inaugurate a trolley express service in Newark and the surrounding towns which are connected by the Consolidated Traction Company's lines. Six cars have been ordered and will be ready for service in a few days. It is proposed to run a trail car for passengers behind each of the express cars.



PLAN OF POWER STATION,

The Advance of the Electric Railway Motor.

BY G. T. H.

No dynamo-electric machine has in so short a time been more radically changed and more efficiently improved than the electric railway motor. When it was demonstrated that it was possible and practicable to operate a street car by electricity, all of the large electrical manufacturing companies designed motors for this service; but it is never possible to break completely away from old ideas, and in no case has this tendency been more apparent than in the case of the electric railway motor. Modern practice has shown us how necessary were these radical changes. At the beginning of electric traction the electric motor which the manufacturers had already produced possessed the following characteristics: First, high speed; second, severe sparking at change of load; third, extreme susceptibility to dust and water; fourth, need of constant attention; fifth, weak torque or turning moment; sixth, great weight for power supply; seven, unsightly overwound drum windings.

This motor when used for traction had to work under the following conditions: First, without any attention whatsoever; second, with water, dust or mud present at all times; third, with severe starting torque; fourth, heavy changes of load at all times; fifth, constant vibration; sixth, no lubrication; seventh, operation under the care of an inexperienced man. Any two more incompatible states of conditions and requirements could not be devised. These adverse conditions are the same to-day as they were then, but the motor has been improved to meet them. Every part of a modern railway motor has been especially designed for the purpose, and has passed through a series of changes both interesting and instructive.

There are three important vital parts of an electric railway motor—the armature, the commutator and the field magnet. Other important parts are the brushes, bearings and the gears. Taking the armature first, the original type was taken directly from the stationary motors which were then manufactured with plain surface-wound rings and drums. The compact drum armature had many attractions, but the trouble from the overwound heads gave the ring armature an advantage, as did also the fact that the greater relative distance of the movable wire from the axis gave greater torque and slower speed. It is a well-known fact that it is not possible to economically wind a bipolar drum armature whose length is not at least one and one half times its diameter. Therefore, the drum armature, to approach the "overall" diameter of a ring, would be excessively long, and of greater power than required. Still, this great advantage did not permit the ring armature to attain a single reduction of power any sooner than the drum. Both seemed to make the transition simultaneously. The ring armature had and still possesses the advantage that, in the event of sections burning out, they can be rewound without disturbing, in any way, their fellows. This is an advantage which is not claimed for any drum-wound armature now built. In the early days of electric motors the drum-wound armature had a mechanical advantage that was not to be underestimated. It was possible to secure the lammelar core of the drum armature upon the shaft in a much more rigid and mechanical manner than that of the ring. Summing up the case, the ring armature was preferable, but the persistent conservatism of many manufacturers of drum armatures and the radical improvements that have been made have done much to make the drum armature superior to the ring, in the eyes of many users.

Up to the time that electric motors came to be re-designed for street railway propulsion, the toothed armature was looked upon with great suspicion as liable to involve spark troubles of a most serious nature. However, the fact that a much lighter equipment would result from the use of toothed armatures caused expert designers carefully to study the problem and effectually solve it. Thereupon both the ring and drum armatures became toothed, and great economy in weight and magnetic power was thus effected. But this change to toothed armatures was a great advantage to the drum type. With surface-wound armatures it is a fact that unless at least two wires are wound in a section it is impossible to have the coils symmetrical, of the same shape and resistance and, at the same time, compact.

Compact, symmetrical windings for surface-wound armatures existed before electric railroading, but for some reason they were never generally adopted. The teeth between the wires on the drum armature give sufficient room to connect the conductors either in a spiral path in the plane of the head of the armature, or diagonally on the cylindrical surface of the armature produced. Two layers of wires are all that are required, and each connector has its path partly on the upper and partly on the lower layer. Each coil may now be machine formed and identical in shape with its mates. They pack closely into the space provided for them, each one having just room enough and no more. Thus they mechanically lock each other in position, and form a well-insulated structure, as it is possible to insulate the coil separately before slipping it onto the core. In the event of a coil being injured or burned, by slipping off a few coils the injured one can be removed or replaced, while the uninjured coils that were removed are not, in consequence, destroyed, as was the case with the old overwound drums.

The time employed in placing the coils on the core is but a few hours, and many companies now claim that two of their armatures of this type can be completed as far as winding and connecting is concerned in one day and by one man. This gives the drum armature prestige over the ring where the ring was formerly superior.

The advent of the multipolar fields facilitates the use of separate coils to even a greater extent, for no rigid rule as to length and diameter need be adopted to secure an economical winding. The present standard motor for street-car propulsion has a toothed multipolar drum armature wound with machine-formed coils. It is the product of successive ideas and their application and is meeting with deserved success.

It has seemed singular that the present ironclad motor did not sooner come into general use, as ironclad machines existed before electric railroading, in the inventions of Eickemeyer and others. Nevertheless, manufacturers seemed to prefer to use their own distinctive types, whether they were suited for the purpose or not. The reason is partly to be found in the convincing force of the oft-repeated statements of each maker that his special type is the only rational and practical form suitable for any service, and partly in the maker's desire to exercise an economy by the use of existing patterns and calculations, even though that economy be a false one.

Therefore, these makers took one of their existing frames that had given good service as a motor and re-designed it for service under a car. Lugs and arms were cast on to the frame, the brushes rigidly fixed, the field magnet series wound, and thus equipped it was sent out for active service. As every one remembers it did not accomplish its mission. It came back to the shop in a few weeks incrusted with dust and mud, with both armature and magnets disabled. The motor was laboriously dismantled, its magnets were removed and rewound, so that it soon became apparent that the use of movable coils for field magnets would greatly facilitate repairs. The motor was then put together and provided with an elaborate enclosure made of sheet iron and rubber cloth, which added to the weight of the equipment. However, this state of things was not to last.

The obstacles that had been met with were very discouraging and it was clear to every one that a new type of field magnet was necessary. First, the motor must be constructed in such a way that it could be more easily taken apart for repairs; second, it must be protected from dust and mud; and third, it must be lighter. The first of these requirements was found in a motor of the hinged type that could be readily opened when repairs were necessary. The second problem was more slow in solution, but eventually was perfectly solved with the development of the ironclad type of motor. In this type the motor becomes its own dust-proof enclosure.

In the meantime the electrical side of the question had not been neglected. Soft steel enabled designers to produce a motor with an intense magnetic field. This gave a slow speed and starting torque sufficient for a single reduction of speed. Then it was that several too sanguine inventors overshot the mark and produced a gearless motor. Not that the gearless motor was by any means a failure, but the particular interurban and long-distance service that it is fitted for was not then demanded, and the motor proved to be a failure in small sizes and in crowded sections. The boom of the gearless motor, therefore, subsided, and anything of that type is always suspiciously regarded by street railway officials. However, the single reduction motor was received with great favor and has become the standard among all street railway companies. Manufacturers differ in methods of connection and the number of coils they use to obtain the multipolar field, but they are unanimous in adopting multipolar types. The street railway motor has now reached such a state of perfection with regard to its windings, that it would be difficult to imagine an accident to it that would involve more than a day's work for two men.

Rapid and radical as the changes have been with armature and field magnet, the commutator, which, after all, takes a very heavy duty of the machine, has been but little improved. In one way this is not the designer's fault. Mechanically, nothing could be better than the rigidly built commutator now in use on railway motors. The bars are drop-forged, the mica insulation is of the best, and the whole is solidly clamped together under enormous pressure, yet it is well known that a commutator on a railway motor is of very short life. Dust has been effectually excluded from the commutator, but the evil of sparking is still there, and will continue to gnaw the commutator away until it is cured. Sparking on an ordinary railway motor of good design and otherwise in perfect condition results from two causes: first, dirt on the commutator, and second, improper position of the brushes. The proper position of the brushes is on the neutral line which fluctuates back and forth with the work the motor is doing. Either this fluctuation must be stopped by some method of winding which will counteract the armature reaction, or else the brushes must be moved to follow it. Neither has been done. The modern well-designed street railway motor has quite a wide non-sparking zone, but the dirt which will inevitably collect is sure to aggravate sparking, thus narrowing the zone, and unless the brush is in exactly a non-sparking position, the commutator will be worn away. Inventors have suggested methods for making the neutral line stationary, but this does not seem to have met with popular approval. Common practice is to clamp the brushes firmly in the position which is found to be the best average, and the commutator is removed if required. Perfection for traction motors cannot be claimed until a machine is produced that shall have long and equal life in all its parts.

The sweep that the brushes of a railway commutator take in exactly following the neutral line in its fluctuations is much larger than on any dynamo or stationary motor, because of the fact that the motor is required to reverse. If there were absolutely no armature reaction there would be no shifting of the neutral line, which would then be situate exactly between the pole tips, provided that no lead had been given to the armature connections. As it is, the conditions are as follows: When the motor rotates, say, in a right-hand direction, the neutral line rotates in a reverse direction, and the greater the load the further it extends. When the motor is reversed, the direction of the neutral line also reverses, and is entirely on the other side of the position that it assumes at no load. Therefore, a street railway motor or any motor which runs as much in one direction as the other, should have twice the range of brush adjustment, which would be necessary if its direction of rotation was uniformily the same. There is urgent need of action on this matter, for at present the case is of the worst possible description, and is costing yearly many thousands of dollars. Street railway practice at present dare not risk the complications of a brush adjusting device attached to the controller spindle. It would be well to consider the advisability of two non-sparking positions, one for forward and one for reverse motion, to be operated when reversing the car for the return trip. The commutator is and for some time to come will be the weakest part of a railway equipment, until some day our hopes are realized and the induction motor will propel railway cars.

St. Paul Conductors to Be Armed.

An order has been issued by Supt. Smith, of the Twin City Rapid Transit Company, of St. Paul, authorizing all conductors to carry revolvers if they desire to do so. The order was issued with Mayor Smith's permission. It virtually gives all of the street car conductors the privilege of carrying concealed weapons.

The order is the result of the fact that conductors have recently been robbed on the Hamline and Maria Avenue lines. The conductors are obliged to carry $10 or $15 of their own money for change and feel that they should be allowed some means of protection. The company looks at it in the same light. The men are merely privileged to carry revolvers; there is nothing obligatory about the order.

Street Railway Engineers—XXII.

WILLIAM H. HENDERSON.

Mr. William H. Henderson holds the important position of chief engineer of the Pennsylvania Traction Company, which has arranged so comprehensive a system of electric railways with Lancaster as a centre. The company is now the lessee or owner of eight electric railways, forming a system which has greatly changed the transportation situation in a portion of the State. Mr. Henderson was born in Lancaster County, Pa., in 1863, and was graduated from the Millersville State Normal School in 1882. He taught school for two years, but his tastes inclined toward engineering work. For eight years he was employed in different engineer corps under the supervision of the late Col. S. C. Staymaker. He gained, in the several capacities in which he was engaged, a broad experience in practical railway work. He served first as levelman, then as transit man, and subsequently as principal assistant of Col. Staymaker on preliminary and location surveys for the extension of the New Holland Railway from New Holland to Lancaster and on the extension of the Lancaster, Oxford & Southern Railway from Quarryville, Pa., to Singerly, Md., and on the construction of several smaller roads. Later Mr. Henderson engaged in electric railway work, and was employed on the location and construction of the Lancaster & Columbia Electric Railway. For a year he held the position of assistant in the office of the City Engineer, of Lancaster, Pa. Upon the death of Col. Staymaker, in February, 1894, his son was appointed Chief Engineer of the Pennsylvania Traction Company, with Mr. Henderson as his principal assistant. In December of the same year the former resigned and Mr. Henderson was appointed in his place. The company has had a vast amount of engineering work under way. During the last year and a half various surveys have been made for extensions of the Pennsylvania traction system to suburban towns about Lancaster, among the number being the lines to Strasburg, Ephrata, New Holland, Terre Hill, Lititz and Manheim. During this time a great deal of construction work has been executed and this work is still in progress.

WILLIAM H. HENDERSON.

Fight for a Franchise.

In the October 12 issue of the Electric Railway Gazette, mention was made of the bidding by the People's Traction Company, the North New York Traction Company, and the Southern Boulevard Railway Company, for a street railway franchise in the Twenty-third and Twenty-fourth wards in New York City. In order to invalidate the sale of the franchise the rival bidders offered extraordinary prices. The bidding did not stop until the People's Company offered 6,975 per cent. of its gross receipts for the privilege of building the road. The fight was then taken to the courts, and a temporary injunction was obtained restraining the city comptroller from making any award of the franchise pending the trial of the suit to set aside the bid made by the People's Company. Decision has been reserved on the motion to make the injunction permanent.

Trolley Lines on the New East River Bridge.

The commissioners of the new East River Bridge, to connect Brooklyn and New York, are considering plans by which Brooklyn surface cars may run over the structure. The cars would reach the bridge at the foot of Broadway, in Brooklyn, and would deposit their passengers at the foot of Delancey Street, in New York. The plan presents a number of commendable features. In the first place such an arrangement would simplify to a very great extent the matter of terminal stations, the provision for which in the present Brooklyn Bridge has proved so formidable a problem. It is a serious question whether a satisfactory terminal for the present structure can be built. The new station which has just been thrown open to the public after months of delay, and the expenditure of a vast sum of money, certainly does not meet the requirements of the public. The convenience of the vast throng of persons who go to and from New York daily would be vastly enhanced could they cross the river without the trouble and loss of time involved in changing cars. The plan which is now under discussion by the commissioners of the new bridge provides for giving a franchise to a surface railway upon the payment of a stipulated amount. It is probable that no definite action will be taken in the near future. Since the plan has been under discussion it has been strongly approved by many representative citizens of Brooklyn. If the project is adopted it is believed that considerable traffic will be attracted from the present bridge.

Electric Locomotives.

The Baldwin Locomotive Works, it is announced, have received several orders for light weight electric locomotives for high speed in passenger service, and are developing and building freight locomotives for hauling trains of six or eight hundred tons. The passenger locomotives are to haul 200 tons. The Baldwin Locomotive Works are now building two electric freight locomotives, one of which is to be used by the Westinghouse Electric & Manufacturing Company for switching purposes in its freight yard near Pittsburg, and incidentally for exhibition purposes. The other goes to the freight yards of a railway company.

ELECTRIC RAILWAY GAZETTE

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REMEDYING THE ELECTROLYTIC EVIL.

We print elsewhere in this issue an article by Mr. Harold P. Brown, in which he describes some of the details of his system for preventing the electrolysis of buried pipes. Mr. Brown also replies to a comment recently made in these columns relative to the method which he proposes. It will be remembered that in his system he connects to the pipes a dynamo which is run at a slightly higher voltage than the station generators, with the result that the current takes the pipes in preference at the points attached to the machine of higher voltage. The criticism was made that the plan might not overcome the trouble because of the fact that the joints of the pipes were imperfect and the pipes themselves were in some instances little more than holes in the ground lined with oxide of iron. Mr. Brown points out that his system may be extended and poor joints in pipes avoided by connecting on beyond such joints with the wire from the negative side of the high-pressure dynamo, and that the voltage relatively to the pipes may also be controlled by connecting to the track at a distant point from this same wire. Due credit for this extension in the application of the system was not given in the article referred to. It seems hardly credible, as Mr. Brown says, that any road should have a ground return so poor that 25 per cent. of the power is lost. This is equivalent to a drop of 137 volts at the full station load. This being the average drop, the maximum drop would be very much greater. This drop is due partly to plain C R losses, and to thermal and electrolytic inverse E. M. Fs. and, it barely possible, to earth E. M. Fs. Mr. Brown states that with a current of 1,500 amperes, the drop is one half a volt per bonded rail joint, the bond being of 0000 copper and secured in the best possible manner. Assuming as the worst possible case that the bond is the only connecting link between the two rails and that it is 3 feet long, even if it could carry this current without fusing, the drop due to C R is but .23 of a volt, leaving more than 50 per cent. for electrolytic and thermal E. M. Fs. If this is the fact it is most important, and any experimental proofs that Mr. Brown may have will be eagerly read by all interested persons. If the validity of this point is established, unless we run underground feeders, we must either weld our rail joints or use an equivalent method, for we cannot otherwise avoid the remaining drop of .27 of a volt per joint, no matter how heavily we bond our rails.

REPAIR SHOP SUGGESTION.

One of the great sources of expense in the repair of electric power and lighting apparatus may be traced to the fact that no convenient and efficient connection from armature to commutator bar has yet been devised; at least, no device of the kind has yet been produced at a cost that is not prohibitive. Machine-formed coils have been designed with great care, and the work of winding the armature has been reduced to a minimum, but "the old reliable way" of soldering the terminal wires into slots in the bars is invariably practiced. The initial soldering of the wires is not so objectionable as the trouble attendant upon their removal for repairs. In some forms of winding it is necessary to go around the armature twice with the soldering iron before all the wires can be liberated. The solder on the ends of the wires amalgamates them into a very brittle state, and because of this fact it is often necessary to reject a coil or to piece its connector. Either course is obviously undesirable. An apparently efficient method for remedying the trouble has been suggested, and as it seems to be growing in favor, a brief description may prove of interest. The commutator is solidly built, and the wires are driven into the slots, a flat piece of very soft solder being interposed between each pair of wires and in the bottom of each slot. The little column of wires interlaid with soft solder sheets is hammered into the slots, the solder spreading out under the pressure and shaping itself to the wires. The slots are of such depth that the last wire projects about one half of its diameter outside. On top of the wires is placed a thin hard strip of fibre which completely surrounds the commutator lugs and is secured in position by an ordinary binding wire similar to that used on the armature. To disconnect the commutator it is merely necessary to cut the last-named wire, when, after the other fasteners have been removed, the commutator may readily be drawn off the shaft. This method seems to meet the difficulty which has been referred to, and at the same time the work of connection is less than that which is involved under the existing practice. By this treatment the possibility of making the ends of the wires brittle is avoided, and it presents the great advantage that it is cheap.

STREET RAILWAY CONVENTIONS.

It may be assumed that most of the readers of the Electric Railway Gazette are now familiar with the report of the Montreal Convention of the American Street Railway Association, and it is probably equally safe to conclude that they have commented upon the meeting. Were it possible to collect these opinions a great many suggestions of value to the present officers of the Association would be available. There is no doubt that the proceedings have been criticised, and it may be useful before the convention is forgotten to note the points wherein it is thought improvements would be possible. Beyond all doubt the sessions of the convention were disappointing. The papers were few in number, and while these were excellent and timely, the wide range of questions now of vital interest to street railway men was not formally brought to the attention of the delegates. The lack of provision in this respect was wholly unnecessary. A score of street railway men, at the least reckoning, who were present at the meeting, could and would have prepared timely papers had they been requested so to do. There is no lack of ability in the membership, but certainly there was a noticeable absence of the product of ability at Montreal, and the fault must lie with those who had the literary programme in charge. To this fact is to be ascribed the want of interest in the proceedings, and the necessity of deputizing a member to secure a quorum essential for the transaction of business. It seems rather ridiculous that a convention which called together in the neighborhood of 1,000 persons could attract only a corporal's guard to its formal sessions. Another disappointment experienced by one who reads the report results from the fact that the discussion of practical topics was exceedingly meagre. If the members gained much information from the interchange of opinion, they obtained it by personal conversations, and not by attending the meetings. It seems to us that the conventions should afford those who attend them a large fund of valuable information relating to the practical every-day operation and management of railways. Such information can only be elicited by a discussion, and to provoke it should be the earnest effort of those charged with the preparation of the convention programme. To make this feature of the meetings successful, speakers must be pledged to open and take part in the consideration of practical topics. When once under way a lively discussion will take care of itself, but if the preliminary arrangement is neglected, failure may be confidently expected. It is in these two respects that we have heard the last convention most strongly criticised. The new officers can easily improve the meetings in the two particulars mentioned and thereby make the conventions of far greater practical benefit to those whose interests they are designed to serve.

Improvements in St. Louis.

In the last issue of the Electric Railway Gazette editorial reference was made to the fact that many street railway improvements had been made in St. Louis, where the American Street Railway Association will hold its next Convention, in October, 1896. An officer of the Lindell Railway, of that city, recently referred to the same fact. He is quoted by the St. Louis *Globe-Democrat* as follows: "It is not my intention of boasting of what the Lindell has done, but it must be admitted by those who have followed the progress made that the Lindell took the initiative in a great number of the innovations. It was the Lindell company that first introduced the transfer ticket; the first company to abandon trailers and to use large cars with double trucks; the first to introduce the palace on wheels; the first to build long extensions, and the first to bring out the platform closed at one end. When some of these innovations were introduced there were parties who predicted that these new-fangled notions would bankrupt the company. I notice that all the things enumerated above have been adopted by companies all over the country."

Philadelphia Trolley Mail Service.

Since the three great electric railway systems of Philadelphia have come under one management, the postal authorities of the city assert that the trolley mail service can be so rearranged and perfected that the wagon service may be dispensed with almost entirely.

Labor Union Resolutions in Philadelphia.

Some of the labor unions of Philadelphia have declared war on the Union Traction Company because of its opposition to union labor. Resolutions were recently adopted denouncing the action of General Manager Beetem in discharging conductors and motormen, "because of membership in the Amalgamated Association of Street Railway Employees, as an act of tyranny, directly subversive of the rights of American citizenship." The officers of the union were instructed to petition City Councils to grant no further privileges to the Union Traction Company or any of its leased line, until the right of its employees to join a labor organization be recognized.

A resolution was adopted requesting the delegates to the United Labor League to bring before that body the question as to whether the present time is opportune to enter upon an active and extensive agitation in favor of the municipal ownership of the street railways of this city.

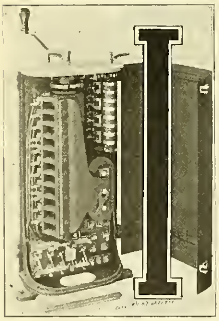
To a reporter who asked him why the men were discharged General Manager Beetem said: "These men were discharged for pretending to take an interest in their work and yet secretly exerting their influence and taking an active interest in the affair of the Amalgamated Association, and all others who are found to be taking a like active interest in the association will be as summarily dealt with. I am always willing to meet any of the employees of the Union Traction Company, who consider that they have grievances, but under no circumstances will I deal with any committee or single representative of any association."

Electric Car Tests.

BY HERMANN S. HERING, M.E.,
Assisted by
CHARLES REUTLINGER and B. HARRISON BRANCH.

(*Continued from page 236.*)

IV. PERFORMANCE OF CARS ON STRAIGHT GRADES.



In order to determine the performance of cars when operated under steady conditions, tests were made with several cars run on straight grades at various loads and controller positions. Such tests are no criterion for road work, with its varying conditions, but are of interest in showing the results of steady conditions and the effect of running the motors in series or in parallel. Several different cars were used in these tests and in some cases they pulled each other as trailers. They are the same cars that were used in the tests already described, and were equipped as before with a Boyer speed recorder, portable Thomson wattmeter and Weston ammeters and voltmeters. The tests were made on the Pikesville road of the Baltimore Traction Company, most of them on the two long grades, 5.96 per cent. and 2.6 per cent., already mentioned, and others on some of the smaller grades. The cars were started several hundred feet below the point where the tests had to begin in order to insure the speed being absolutely uniform during the test.

At the instant the car passed the previously designated pole, the time was noted and the readings were begun and taken frequently until the other limit of the grade was reached. The readings were found to be very constant, and from them the average values were computed.

Each car was run on these selected portions of the road under various loads and controller positions; for instance, one car would be run on the 5.96 per cent. grade with the motors in series and no other load but the observers; this test would be repeated several times, then the car run over the same grade with the motors in parallel and with the same load, and again repeated as before; the car would then be run over the other grade, 2.6 per cent., first with the motors in series and then with the motors in parallel, each test being repeated several times. A trailer would then be coupled on to the car and several or all of these tests repeated with this different load, and afterward the trailer car would be replaced by a motor car which, having a much greater weight, would increase the load of the test car, and the tests again repeated. Owing to unfortunate circumstances this series of tests was not as extensive as desired, many of the results having been thrown out, because of some variations or accidental errors, but those which are fairly reliable are given

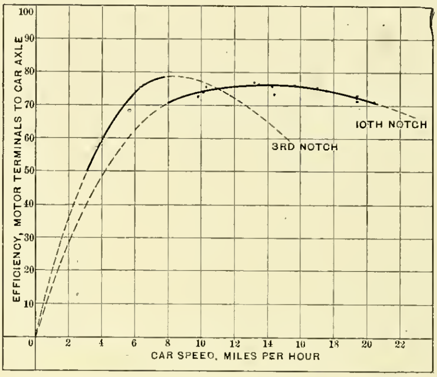


FIG. 25.—VARIATION OF EFFICIENCY WITH SPEED.

Points taken from road test.

NOTES.—Third notch, motors in series; tenth notch, motors in parallel.
Broken lines indicate general form of curves and probably continuation.
Car equipped with two 25-hp No. 3 Westinghouse motors—"G" controllers.

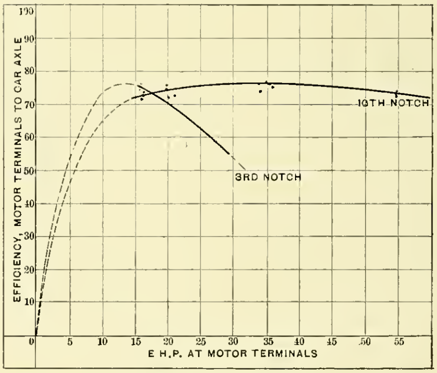


FIG. 26.—VARIATION OF EFFICIENCY WITH POWER.

Points taken from road test.

NOTES.—Third notch, motors in series; tenth notch, motors in parallel.
Broken lines indicate general form of curves and probable continuation.
Car equipped with two 25-hp No. 3 Westinghouse motors—"G" controllers.

in the tables, and they can be considered as correct within a very few per cent.

The results of the tests made in April and June, 1893, at about the time of the first road test, were obtained with car No. 233, whose traction coefficient was determined, and has already been given in Table 2, and this is the same car that was used in making the test shown in Figs. 14, 15 and 16. In some of these tests the dynamometer was used in coupling the motor and trailer car, and from its reading the mechanical horse-power of the trailer was computed, and where there was some acceleration, it was computed and allowed for. The net efficiency of the motors was determined from the total mechanical horse-power, and the electrical horse-power supplied to the motors; these values, though obtained from a road test, agree fairly well with the designs of the manufacturers, when it is taken into account that the friction of the gears and journals is included. Figs. 25 and 26 contain the curves plotted between the values of the efficiency and car speed, and between the efficiency and electrical horse-power at the motor terminals obtained in these tests. They show the maximum efficiency to be reached with a car speed of about 14 miles an hour with the motors in parallel and seven miles an hour with the motors in series. The broken lines indicate the general form of such curves and the probable continuation of the curves obtained from these results. The results are very good considering the fact that they were obtained from road tests.

TABLE 6.—DIFFERENCE BETWEEN THE MOTORS WHILE RUNNING IN PARALLEL, AND IN SERIES.

Car No. 233, Equipped with 2—25-HP Westinghouse No. 3, S. R. Motors.

Controller on Tenth Notch. Motors in Parallel.

Car Volts.	Total Amperes.	Amperes, Motor No. 1.	Amperes, Motor No. 2.	Difference.	E. H. P. Motor No. 1.	E. H. P. Motor No. 2.	Difference in E. H. P.	Difference in per cent.
470	87.4	41.3	46.1	4.8	26.0	29.0	3.0	5.5
473	86.0	40.4	45.6	5.2	25.6	28.9	3.3	6.0
487	67.7	31.5	36.2	4.7	20.6	23.6	3.0	6.8
487	45.5	20.9	24.6	3.7	13.6	16.0	2.4	8.1
465	32.4	14.5	17.9	3.4	9.0	11.1	2.1	10.4

Controller on Third Notch. Motors in Series.

Volts, Motor No. 1.	Volts, Motor No. 2.	Difference.	Total Amperes	E. H. P. Motor No. 1.	E. H. P. Motor No. 2.	Difference in E. H. P.	Difference in per cent.
242	248	6	41.8	13.56	13.90	0.34	1.3

Note.—These results are each the mean of from 6 to 12 observations.

TABLE 8.—OBSERVED AND COMPUTED RESULTS OF THE PERFORMANCE OF VARIOUS ELECTRIC CARS ON STRAIGHT GRADES AT STEADY SPEEDS WITH AND WITHOUT TRAILERS, AND AT SEVERAL CONTROLLER POSITIONS.

Tests Made on the Pikesville Road of the Baltimore Traction Company.

	Test Number.	Number of Trials.	Cars Operated.	Controller Position.	Track Data. Grade: per cent.	Pole Numbers at which Test was made.	Distance-Feet.	Time. Interval in Seconds.	Speed. Feet per Second.	Miles per Hour.	Number Passengers and Crew.	Car Weights. Motor Car and Passengers.	Trailer and Passengers.	Total.	Electrical Horse-Power. Total Amperes.	Volts bet. Trolley & Gr'nd.	Electrical H.P.	Watt-Hours.	Watt Hours per Car Mile.	Motorman.	Date of Test.	Notes.
	1	2	3	4 o	5 o	6 o	7 o	8 o	9 c	10 c	11 o	12 o	13 o	14 c	15 o	16 o	17 c	18 c	19 c	20	21	22
I	1	3	234 alone.	3	5.96	24 31	870.5	143	6.08	4.15	9	17135	—	17135	35.5	434	21.6	641	3995	Merton	June 4, 1894.	Car Equipments. No 234 2-25 HP No. 3 S.R. Westinghouse Motors. Single Truck, "Bemis" No. 64 2-25 HP "G E 800" Motors. Single Truck "Lord Baltimore, No 2." No 31 2-25 HP, No. 16, S.R. Edison Motors; Double Truck, "M'Guir Car Weights, (actual.) No 234, 15735. No. 64, 14715. No 31, 21810. No. 166, 5835. Computed Results obtained as follows: Col 9 = Col 7 ÷ Col. 8 Col 10 = Col 9 × $\frac{3600}{5280}$ Col. 14 = Col. 12 + Col 13 Col. 17 = Col. 15 × Col 16 ÷ 746 Col. 18 = Col. 15 × Col 16 × $\frac{\text{Col. 8}}{3600}$ Col. 19 = Col 18 ÷ $\frac{\text{Col. 7}}{5280}$ Controller Positions: Car No 234, "G" Controller Pos. No. 3 Motors in Series. " No. 10 " " Parallel. Cars No. 64 and 31, "K" Controller Pos. 3 motors in Series, full field. " 4 " " shunted " " 6 " Parallel, full field. " 7 " " shunted " Explanatory. o at the head of a column means observed values. c means computed values. Roman Numerals designate the series of tests. All the observed values given are the means of the number of trials given in Column 2. The Track Data in Columns 5 & 7 was taken from recent survey. The Weights of passengers and crew, as well as Cars, are actual.
	2	3	-	10	-	-	-	57	15.26	10.41	6	16935	—	16935	72.4	445	43.2	510	3096	-	-	
	3	3	-	3	2.6	68 76	980.5	116	8.31	5.66	10	17185	—	17185	22.2	421	12.5	307	1855	-	-	
	4	3	-	10	-	-	-	54	18.14	12.37	10	17235	—	17235	52.9	413	29.3	328	1768	-	-	
II	1	1	234 pulling 166	3	2.6	68 76	980.5	133	7.37	5.02	10	17030	6045	23075	25.2	424	14.9	411	2217	-	-	
	2	2	-	10	-	-	-	62	15.80	10.77	10	17030	-	-	56.2	400	30.1	387	2087	-	-	
III	1	1	234 pulling 64	3	5.96	24 31	870.5	331	2.63	1.79	11	16880	15150	32030	57.5	458	35.3	2420	14700	-	May 31, 1894.	
	2	2	-	10	-	-	-	90	9.67	6.59	11	16730	15300	-	117.5	437	68.9	1265	7800	-	-	
	3	2	-	3	2.6	68 76	980.5	192	5.10	3.46	11	16880	15150	-	38.0	428	21.8	868	4680	-	-	
	4	2	-	10	-	-	-	77	12.73	8.69	12	-	15300	32180	76.2	401	42.0	671	3615	-	-	
IV	1	1	64 alone	3	5.96	24 31	870.5	109	7.98	5.44	8	15815	—	15815	37.0	462	22.9	517	3140	Miller.	-	
	2	1	-	4	-	-	-	92	9.46	6.46	6	-	—	-	41.8	464	26.0	498	3012	-	-	
	3	1	-	6	-	-	-	53	16.41	11.20	6	-	—	-	77.9	444	46.4	509	3090	-	-	
	4	2	-	7	-	-	-	44	19.77	13.47	6	-	—	-	88.6	450	53.4	487	2958	-	-	
	3	1	-	3	2.6	68 76	980.5	104	9.43	6.43	10	16215	—	16215	25.0	435	14.6	314	1693	-	-	
	6	1	-	4	-	-	-	95	10.32	7.06	10	-	—	-	30.3	430	17.5	344	1855	-	-	
	7	1	-	6	-	-	-	52	16.85	12.86	10	-	—	-	54.8	413	30.3	327	1763	-	-	
	8	3	-	7	-	-	-	45	21.78	14.85	11	16315	—	16315	64.9	419	36.4	340	1833	-	-	
V	1	4	64 pulling 234	3	5.96	24 31	870.5	158	5.51	3.75	12	16050	16130	32180	60.0	455	36.4	1198	7275	-	-	
	2	2	-	6	-	-	-	69	12.60	8.60	12	16200	15980	-	122.0	435	71.2	1016	6170	-	-	
	3	1	-	3	2.6	68 76	980.5	141	6.95	4.74	11	15900	16130	32030	36.7	429	22.3	655	3530	-	-	
	4	2	-	6	-	-	-	68	14.41	9.84	12	16050	16055	32105	80.1	405	43.5	612	3300	-	-	
VI	1	1	31 alone	3	5.96	24 31	870.5	170	5.12	3.49	12	23573	—	23573	42.6	459	26.2	924	5615	-	June 16, 1894	
	2	1	-	4	-	-	-	165	5.27	3.58	12	-	—	-	44.7	460	27.6	943	5730	-	-	
	3	1	-	6	-	-	-	74	11.75	8.03	12	-	—	-	90.6	445	54.1	829	5035	-	-	
	4	2	-	7	-	-	-	71	12.25	8.37	12	-	—	-	91.9	446	55.0	606	4910	-	-	
	5	1	-	3	2.6	68 76	980.5	151	6.49	4.37	12	-	—	-	27.0	429	15.5	432	2652	-	-	
	6	1	-	4	-	-	-	144	6.81	4.64	12	-	—	-	28.0	427	15.0	479	2585	-	-	
	7	1	-	6	-	-	-	75	13.07	8.93	12	-	—	-	62.7	421	35.4	550	2965	-	-	
	8	1	-	7	-	-	-	64	15.31	10.44	12	-	—	-	56.7	452	34.0	451	2430	-	-	

Table 6 contains the results of a comparison of the motors of car No. 233 while running in parallel and in series, and Fig. 27 is a curve between the electrical horse-power of the motors and the difference between the motors. It is very seldom that the motors run more closely than they did in this case unless special care has been taken. This difference may be due to differences in the resistance of the motors, but more probably to differences in the size of the car wheels, as the wheels are very apt to wear differently.

While the gears were off, during the test of the traction coefficient, the motors were run empty and the power required to drive them measured. Table 7 contains the results and they are plotted in Fig. 28, which curve may be called the curve between "stray power" and speed. As results obtained from road tests and from cars normally in actual service, they have a distinct value as com-

TABLE 7.—RELATION BETWEEN SPEED AND LOSSES WITH GEARS OFF.

Car No. 233, Equipped with 2—25-HP Westinghouse No. 3, S. R. Motors.

Equivalent car speed. Miles per hour.	Volts across motor terminals.	Amperes.	E. H. P. lost in motors.
25.2	285	5.70	2.18
23.3	265	6.15	2.18
23.1	270	5.85	2.12
21.5	240	5.95	1.91
20.4	232	5.95	1.85
19.3	215	5.80	1.67
15.7	181	6.25	1.52
15.7	160	6.35	1.36
14.1	145	6.45	1.25
13.6	158	6.10	1.29
11.9	144	6.15	1.19
9.6	120	5.7	0.92
9.3	108	5.4	0.78
8.5	102	5.5	0.75
8.3	100	5.3	0.71
8.1	95	5.2	0.66
7.5	85	5.2	0.59
6.9	82	5.3	0.58
6.5	77	5.3	0.55

pared with results obtained from ideal conditions in the laboratory.

Table 8 contains results obtained on the same portions of the road the year following, from cars No. 234, No. 64 and No. 31, all of which were run on the 5.96 per cent. and 2.6 per cent. grade at various loads, and with the motors in series and in parallel, and in the case of the "G. E. 800" motor, also with shunted field.

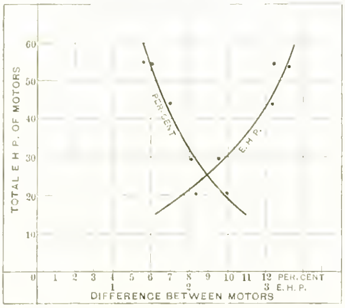


FIG 27 DIFFERENCE BETWEEN MOTORS RUNNING IN PARALLEL.

Car No. 233 equipped with two 25-hp Westinghouse No. 3 motors. Points taken from road test.

The car equipments, the car weight and sundry other information is all given in the table, and no brief allusions or extracts can be made to advantage. The results in the table are given in very concise form, as the averages of a number of trials, and will repay careful study. Bearing in mind that these tests were all made under similar conditions, it is interesting to note the differences of speed, current, horse-power and watt-hours between the different cars and under different controller positions. The motors were loaded from 12.5 to 71.2 hp, which is quite a range in power.

TABLE 9.—APPENDICES TO TABLES 8 AND 10.

Appendix to Table 8.					Appendix to Table 10.			
						Round trip.		
Test number, Table 8.		Electrical horse-power, per ton.	Watt-hours per ton.	Watt-hours per ton-mile.	Car numbers, Table 10.	Electrical horse-power, per ton.	Watt-hours, per ton.	Watt-hours, per ton-mile.
a.		*b.*	*c.*	*d.*	*a.*	*b.*	*c.*	*d.*
I.	1	2.52	74.9	467	234	2.24	1160	89.2
	2	5.11	59.2	366	234	1.75	989	76.1
	3	1.46	35.7	193	234	2.07	1273	97.8
	4	3.40	38.1	205	234	2.01	1086	83.6
					64	2.51	1486	115.1
					31	2.01	1343	103.3
II.	1	1.29	35.6	102				
	2	2.61	33.5	181				
					64	2.36	1427	142.7
					64	1.90	1350	135.0
III.	1	2.21	151.2	918	64	2.17	1486	148.7
	2	4.31	80.3	487	64	3.31	1530	153.0
	3	1.36	54.2	293	234	2.13	1285	128.5
	4	2.61	41.7	225	31	2.06	1386	138.6
IV.	1	2.93	66.2	403	64	3.29	577	139.1
	2	3.33	63.5	386	64	2.53	535	132.9
	3	5.94	65.2	396	64	2.46	529	129.2
	4	6.84	62.4	379	64	3.49	541	132.2
	5	1.80	38.7	209	234	2.62	462	113.1
	6	2.16	42.4	224	31	2.56	536	131.2
	7	3.74	40.3	217				
	8	4.46	41.7	225				
					314	1.13	1698	132.8
					234	1.56	1549	126.5
V.	1	2.26	74.4	452	314	1.58	1472	139.1
	2	4.42	63.1	383	314	1.58	922	170.7
	3	1.39	40.9	220	314	1.63	721	155.5
	4	2.71	38.1	206	4	....	....	....
					75	....	....	....
VI.	1	2.22	78.5	477				
	2	2.34	80.1	487				
	3	4.59	70.4	427				
	4	4.67	68.6	417				
	5	1.32	41.7	225				
	6	1.36	40.7	219				
	7	3.01	46.7	252				
	8	2.89	38.3	206				

Owing to the difference in weight between the cars the energy required to operate the cars is given in Table 9 in *electrical horse-power per ton, watt-hours per ton* and *watt-hours per ton-mile*, which values were obtained by dividing the totals by the weight of the car in tons. From these figures more correct comparisons can be made than when the weight is not taken into consideration.

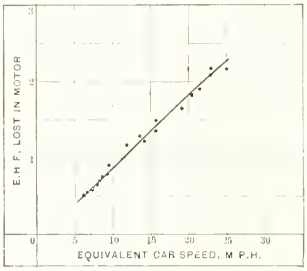


FIG. 28 —RELATION BETWEEN SPEED AND LOSSES WITH GEARS OFF.

Car No. 233 equipped with two 25-hp Westinghouse No. 3 motors. Points taken from road test.

(*To be continued.*)

A Remedy for the Electrolytic Evil.

BY HAROLD P. BROWN.

In your issue of the twelfth instant you publish a diagram of my method of electrolysis prevention as used in Newark and Buffalo, but make several criticisms upon the same which are perfectly just when based solely upon the diagram. But as in every article I have written on the subject, and also in my patent specifications, I make the same criticisms and then show the methods of meeting them which are effective both in theory and practice, your article does me a serious injustice. I therefore quote from an article in the October number of *Cassier's Magazine*:

"Referring more particularly to the figure, *A* represents the main battery of dynamos, whose positive poles *d* are joined to the trolley wire *T*, and whose negative poles *e* are connected to the rails in the ordinary manner. These dynamos are adjusted to maintain the usual 550 volts pressure between *d* and *e*. The dynamo *B*, represents at first about one quarter of the total capacity of the station; but the proportion can be reduced when this plan has been put into service. Its positive *d'*, is connected to the trolley wire *T*, but its negative pole *e'*, is connected by suitable feeder wire *m* to the points *t*, on the pipes which were previously positive to the rails. The pressure of dynamo *B* is then so adjusted that it gives 5 to 12 volts more than dynamo *A*. As their positive poles are joined, this difference of pressure asserts itself by maintaining the pipes negative to the rails by 12 volts, less the previous positive charge, and the loss incurred in passing the current through the feeder wire *m*.

"There is no difficulty in keeping the two sets of dynamos at just the proper difference of pressure to secure this result, and the railways would be eager enough to do this if they realized that their station load could thus be reduced about 20 per cent. At the Boyd Street Power House of the Consolidated Traction Company, at Newark, N. J., the chief engineer, Mr. Geo. E. Talcott, found that 300 hp was saved in this way.

"The method, as far as described, entirely checks electrolysis of the pipes unless it be around some poor joint on same. Such a joint can be easily detected by a low-reading voltmeter at the surface of the street, and the action stopped by continuing the wire *m*, diminished in size, to a point beyond the poor joint.

"It is true that, as far as described, the tendency of this method is to slightly increase the current flow on the pipes, but this is only the first step.

"The current reaches the pipes at *r r*, near the ends of the railway lines, and there a difference of 15 or more volts has often been found, the rails being positive to the pipes. This difference causes a heavy flow to the pipes, and is caused by poor bonding between the rails and by insufficient rail-feeder wires, or by the fact that the network of pipes may lead directly to the power-house, while the lines of rails may take a roundabout course. But with proper bonding, the difference of pressure between rails and pipes at *r r*, may be cut down to one or two volts by carrying out from the higher pressure dynamo *B*, a continuation of the wire *m*, to the distant rails at *r r*. Then, with the proper feeder regulators in the wires *m*, the rails at *r r* and the pipes at *t* can be kept at nearly the same potential, and the current flow on the pipes can be cut down to a minimum. However, even this scheme would not be permanent if the ordinary methods were used of making electrical connections with the pipes.

"After several years of experiments at the Edison Laboratory, but one contact metal or alloy was found that, on a steel rail or an iron pipe, would prevent a film of iron rust from penetrating between the surfaces and ruining the contact. This "plastic alloy," as it is called, in connection with Mr. Edison's simple process of amalgamating iron or steel, forms a perfect electrical "union" of the metals instead of a mere mechanical contact; its resistance is negligible even with two thousand amperes current through a square inch of surface, and it will neither rust nor break. Several hundred of these plastic joints have been in service as rail bonds for over five years, and the rails, as far as electrical conductivity is concerned, are practically continuous, and there is no sign of corrosion.

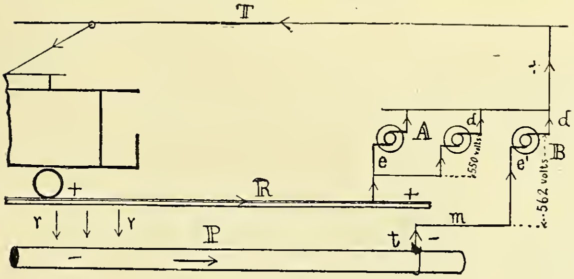


DIAGRAM OF BROWN METHOD.

"Neither of these results can possibly be obtained with copper, since an iron and copper contact produces a serious and unavoidable thermoelectric loss, which is about six times as large as the loss due to the resistance of the metals. Thousands of these plastic joints have been used in the past year, and the electrical result is better than with welded joints. When it is remembered that a new copper bond, five eighths of an inch in diameter, having the best mechanical contact, causes a loss of a half volt per joint with 1,500 amperes, it is easy to realize that any large railway, by securing perfect bonding and by stopping pipe corrosion, can easily make a reduction of from 20 to 40 per cent. in the power expended in operating its cars.

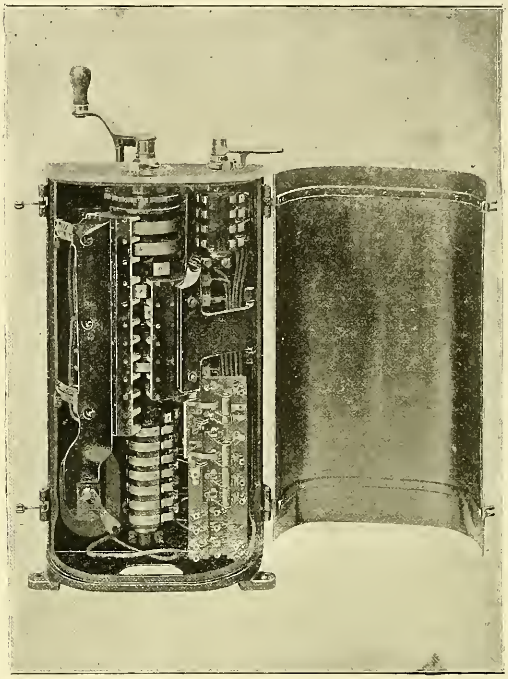
"To apply the plastic alloy for pipe protection, a few square inches on the top of the pipe are filed clean of paint or scale and rubbed with Mr. Edison's compound, which at once turns any iron rust into pure metallic iron and amalgamates the surface. Metallurgists have long considered impossible a stable iron amalgam, but it nevertheless exists, and is so permanent that neither water nor any reagent which it will encounter under the streets can decompose it, nor rust the iron surface beneath it. A U-shaped bolt is then slipped under the pipe and a cast-iron yoke is placed over it. The end of the feeder wire has been brazed to a sheet copper saddle fitted between the top of the pipe and the bottom of the yoke. The centre of the saddle on each side of the wire is cut away to form a receptacle into which, after the copper has been amalgamated, is placed the plastic alloy. The nuts are then tightened up and locked. When a joint between iron and copper is thus prepared, all the contact resistance disappears and the thermoelectric loss is much reduced. But when the alloy is used between iron or steel surfaces, both contact resistance and thermoelectric loss disappear.

"Since these joints have remained underground without deterioration for over five years; since, by the above method the pipes can be maintained negative to the rails at any desired potential; and since the net result is a large saving to the railway, there seems to be no excuse for further destruction of pipes from electrolysis."

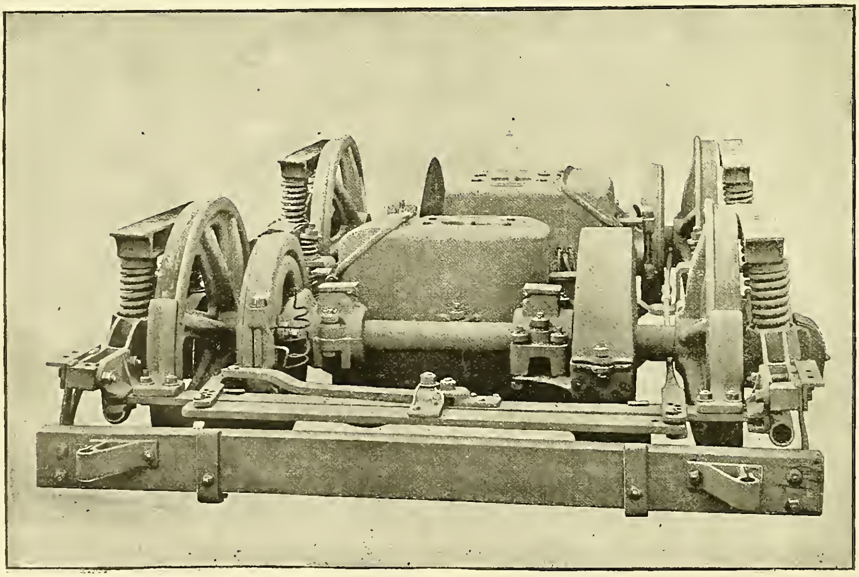
I note what Mr. Bain writes in the same number of the Electric Railway Gazette. He is right in what he says concerning "local disintegration" of underground conductors, especially when steel and copper are used together. But he is wrong when he assumes that "electrically continuous rails" are merely an "ideal construction," and beyond the reach of everyday practice. In Buffalo I have recently put down an underground feeder composed of four lengths of old tram rails, 1,500 feet long, and weighing 52 pounds to the yard. These are connected in parallel with the plastic rail bond. The drop on this feeder with 1,100 amperes is but four volts. I leave him to calculate the resistance of these joints, and the size of a copper conductor to give the same results. Copper cannot compete with properly bonded rails. I have no doubt that his scheme of electrolysis prevention will work on a small road with dry soil, or well drained sand or gravel beneath the rails. But how can a feeder of even one million circular mills compete in conductivity with a network of pipes with cross-section of 20 to 50 inches in many streets and laid in moist earth or clay? In such circumstances upon large roads with intersecting lines we find one quarter to one third the current returning on the pipes in spite of liberal copper feeders. But, if by the plan suggested above the distant rails and the near pipes are held at nearly the same potential, the current flow on the pipes will be reduced to a minimum.

Electric Brake for Street Railway Service.

The illustrations below show a modification of the Sperry electric brake for street cars, which is being manufactured by the General Electrical Company. It contains all the good features of the Sperry brake, and has been developed to perform all the duties of mechanical brakes without their complications and faults. Owing to the fact that the braking power is not derived from the central station, but is generated by the motors themselves, the operation of the device is not interfered with by the jumping of the trolley from the wire. The brake places the car under the absolute control of the motorman, and its operation is no more complicated than the operation of the ordinary controller. Indeed, the controller not only controls the motors, but at the same time operates the brake, starting, accelerating, retarding and braking the car. When making a stop, the controller handle is simply thrown from running to braking position, and electricity does the rest. The operations are, the cutting of all connection with the trolley current, the conversion of the motors into special dynamos for generating current at very low speeds and the instant application of the brakes. The rheostats and contacts used to control the motors in running the car, also control the current generated by the motors and needed to apply the brake. The braking action is two-fold and especially efficient. The rotating armature of the motor, instead of tugging ahead, with its fly-wheel action by its momentum, is itself pulling back and more or less powerfully braking the car through the gears by the retarding effort of its magnetic field, while generating the braking current. The power, therefore, required to perform the work is taken from the energy of the moving car. Not only is the car thus retarded, but the brakes arrest the motion of the wheels directly with a powerful force under perfect control of the motorman. No new and strange device is introduced to the motorman; the combined electric brake and series parallel controller is the K2 controller slightly enlarged and provided with the necessary contacts to perform the operation described above. The brake mechanism is readily attached to the motor and axles—it consists of a cast-iron disc keyed to each axle and a compac electromagnet facing each disc and attached to the motor frame and prevented from revolving by suitable lugs. The maximum current in the brake circuit is regulated by



CONTROLLER USED WITH ELECTRIC BRAKE.



MOTOR EQUIPMENT WITH ELECTRIC BRAKE.

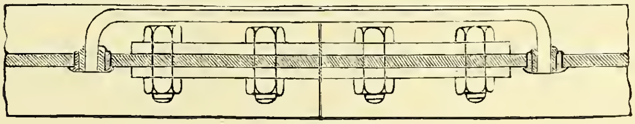
a limit switch adjusted to limit the current automatically to an amount just under the slipping point of the wheels. Independently of this switch, the brake pressure can be graduated by the controller handle and a smooth even motion secured on descending long grades. The disc and shoe are lubricated by a graphite brush, carried in the shoe and pressing against the brake disc. This prevents excessive wear from friction and reduces the resistance between the shoe and disc, an important feature, as the eddy currents set up in the brake and shoe and are even more effective in stopping the car than the simple friction between the shoe and disc. The installation connections of this mechanism are extremely simple.

The company is owner of many fundamental patents on electric brakes, notably those of Vandepoele and Sprague, and has recently acquired the patents of Elmer A. Sperry, who has devoted a large share of his time during the past few years to the perfection of a thoroughly commercial and practical brake. Since the acquirement of the Sperry patents, the engineers of the General Electric Company, in conjunction with Mr. Sperry, have been engaged in working out and perfecting the details required to adapt the electric brake to the series-parallel method of control.

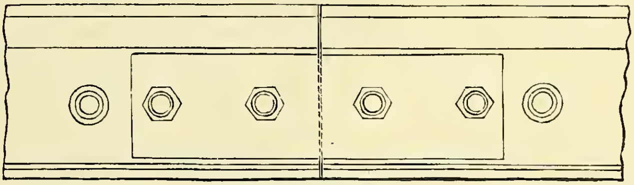
The advantages of the electric brake will be patent to all street railway operators whose acquaintance with other braking methods have been long and disappointing. It can be applied to any axle without removing the wheels, and the wear and tear of the brake does not come upon the tread of the wheel. The wheels of the car cannot skid, and this fact alone should render the electric brake especially popular with street railway men, as it eliminates the possibility of flat wheels and consequent rapid depreciation of rails and rolling stock. It is tested and repaired by the same means as the other electrical devices.

American Rail Bond.

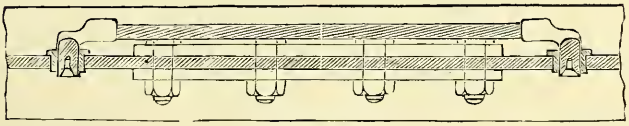
The accompanying cuts show the details of an electrical rail bond introduced by the American Electrical Works, of Providence, R. I. A hole is drilled in the web of the rail and a bushing is inserted. The wire surrounded by a conical bushing is then inserted, and the conical bushing driven home. This expands the outer bushing and forces it firmly against the finished sides of the hole. Additional security is provided by heading the conical bushing with a circuit-shaped bushing tool. It is claimed that the bond proves effective, and that it can be rapidly applied. The company also makes the flexible bond shown in the cut.



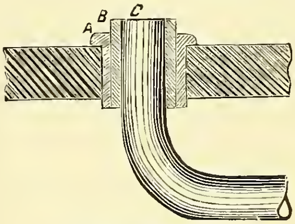
SECTION OF BOND.



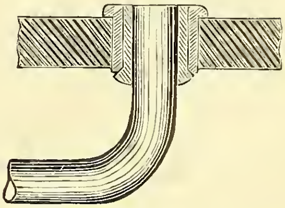
ELEVATION OF BOND.



FLEXIBLE BOND.



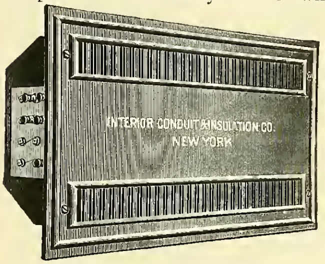
BEFORE DRIVING IN.



AFTER DRIVING IN.

New Electric Car Heater.

The electric car heater shown in the cut has just been introduced by the Interior Conduit & Insulation Company, of New York, and embodies important improvements. It is claimed that unusual efficiency has been obtained in the heaters made by the company, and economy of operation is certainly a factor which appeals strongly to a railway company. All the electric energy absorbed by any electric heater is converted into heat units, and it has in consequence been assumed by many that electric heaters are of necessity of equal efficiency, but this is not the case. It is not sufficient merely to create heat, it must be utilized to the best advantage, and in order that this may be accomplished it is imperative that the heat should be distributed and circulated where it is needed, and as fast as it is generated. It is asserted that in some types of heaters a large proportion of the heat produced has been non-effective for any useful purpose, owing to lack of proper distribution, as most of the air current passes around the coils leaving the heat dormant. Such heaters, it is stated, absorb heat to such an extent that in some instances fire has been caused. In the heater shown in the illustration it is claimed that a continual circulation of air is maintained. The air passes through the coils, and the heat generated is carried off and distributed into the body of the car, the case of the heater remaining perfectly cool. It is claimed that there is absolutely no waste, so that a much higher degree of efficiency is obtained. These heaters are thoroughly well made, neat in appearance and easily installed.



NEW ELECTRIC HEATER.

FINANCIAL NOTES.

RECEIVER FOR THE SOUTH JERSEY RAILWAY.—Chancellor McGill on last Tuesday appointed J. W. Wainwright, of Manasquan, receiver for the South Jersey Street Railway Company, of Point Pleasant. It was shown that the company's property is mortgaged for $100,000, and there is a floating debt of $40,000 which the concern is not able to meet.

STOCK ISSUE APPROVED.—The railway commissioners of Massachusetts have granted the Interstate Consolidated Street Railway Company, Providence, R. I., the right to issue stock to the amount of $100,000. Of this amount $75,000 is to go to the payment of the purchase of the Attleboro, North Attleboro & Wrentham Street Railway, and $25,000 for the improvement of the main road.

DUQUESNE TRACTION.—A gentleman prominent in railway circles and credited with excellent judgment in such matters, is quoted as saying that Duquesne Traction may be, and no doubt is, in bad physical condition, but its prospects for the future are bright—brighter than those of any similar corporation in the city. It serves a very large territory where the room for growth is practically unlimited, and every new dwelling built in that territory is worth on the average $50 per year to the Duquesne. He thinks that "its franchises would be dirt cheap at $2,500,000 if it had n't a mile of track or a single car." The issue of bonds on the Bloomfield line was $250,000, and they were guaranteed by the Pittsburg Traction Company raising the bonded obligation of the latter corporation to $1,000,000.

THE MILWAUKEE RECEIVERSHIP.—Sensational developments are promised as the result of the projected movement to annul the receivership of the Milwaukee Street Railway Company. It is now claimed that there was no proper cause for placing the vast property in the hands of receivers, that it was making money, and that the receivership was the result of collusion to prevent the collection of judgments for personal damages against the company to the extent of about $100,000. These judgments were obtained in various actions in the circuit and superior courts. They still stand upon the books of the clerk of the courts and repeated demands for their payment have met with unfavorable result. Dr. Herman C. Block is the most persistent judgment creditor and it is through his action that the hostile proceedings will be taken in the superior court. The motion for the appointment of an additional receiver to take charge of the money which was not assigned has not been decided in the superior court and it is intended to begin action for the removal of the receivers regardless of this motion.

NEW INCORPORATIONS.

OWOSSO, MICH.—The Owosso & Corunna Electric Street Railway Company has been organized to construct, own and maintain street railways. The promoters are James H. Edmunds, Cape May, N. J.; Irene D. K. Ralph, Lancaster, Pa.; Willis R. Armstrong, Philadelphia, Pa. Capital stock, $50,000.

JERSEY CITY, N. J.—The Puerte Padre Company has been incorporated with a capital stock of $1,000,000, for the purpose of building steam and electric railways and engaging in other enterprises. The promoters are Edmund F. Harding, Brooklyn, N. Y.; Joseph J. Schmidt, New York City; Thomas F. Lennon, Stapleton, S. I.

CHICAGO, ILL.—The Martin Underground Trolley Company has been incorporated in West Virginia, with a capital stock of $5,000,000, for the purpose of constructing, owning and operating the Martin underground trolley system. Those interested are James McDavitt, Gustav Schulz, Edward O'Donnell and Samuel P. Marsh, Chicago, Ill.

XENIA, OHIO.—The Rapid Transit Company has been incorporated for the purpose of building and operating a street railway to be operated by electricity or other motive power and for furnishing electric light, heat and power. Those interested in the project are John Little, S. M. Allison, Marcus Shoup, J. W. Neff and W. R. Baker. Capital stock, $300,000.

SPRINGFIELD, O.—The Dayton, Springfield & Urbana Electric Railway Company, capital stock, $10,000, has been formed to construct and operate an electric railway from Dayton, through Springfield to Urbana; and also to manufacture and sell electricity for light, heat and power. The incorporators are Fred Colburn, John C. Webb, J. S. Harshman, William H. Hanford and H. T. Mathers.

NEWS OF THE WEEK.

BRADFORD, MASS.—Surveyors are at work on Salem Street for the H. D. & G. street railway.

MAINE, N. Y.—It is reported that an electric road will be built between this town and Union.

WILLIAMSPORT, PA.—A new light, heat and power company is to be organized with a capital stock of $100,000.

AUBURN, N. Y.—The G. W. S. F. & C. L. Traction Company will construct a new power-house at Cayuga Lake.

TITUSVILLE, PA.—Leading citizens of Titusville have petitioned the Councils of that city to build an electric street railway.

CHICAGO, ILL.—The stockholders of the Alley "L" road favor putting down surface lines as feeders to the elevated line.

OWOSSO, MICH.—The Owosso & Corunna Street Railway Company is perfecting plans for equipping its lines with electricity.

MEADVILLE, PA.—The Meadville City Council has given a franchise to a company which agrees to build and operate motor cars.

WATERLOO, IA.—A company has been incorporated for the construction of electric street lines in Waterloo and Cedar Falls.

BANGOR, ME.—A petition is being circulated by the Street Railway Company, asking that it be allowed to lay a double track in Main Street.

NILES, MICH.—The Grand Trunk Railway will begin next Spring the construction of an electric railway from Cassopolis, Mich., to Benton Harbor.

ASHLAND, PA.—A charter has been granted to the Mahanoy Valley Street Railway Company to operate a line between Ashland and Gordon, Schuylkill County.

OMAHA, NEB.—The Omaha Water Company has begun suit for $250,000 against the Omaha Street Railway Company for injuries done to the iron water pipes.

SAUGATUCK, CONN.—Work has been begun on the Westport & Saugatuck Electric Railway, and it is expected that the road will be in operation by Dec. 1.

COHOES, N. Y.—Surveyors have commenced work in laying out the proposed extension of the tracks of the Cohoes City Railway, from Main Street to Cedar Grove.

ELIZABETH, N. J.—A syndicate has been looking over the turnpike road from Elizabeth to Summit, with a view to building a trolley line between the two places.

CHICAGO, ILL.—The West Chicago Railway Company has secured a franchise for an electric street line on Western Avenue between Belmont and Milwaukee Avenues.

McKEESPORT, PA.—The McKeesport Council has passed an ordinance giving the McKeesport, Duquesne & Wilmerding Railway Company the right of way over Second Avenue.

LITTLE FALLS, N. Y.—C. L. Pylce, president of the Little Falls & Richfield Springs Electric Railway, is in the city to make arrangements to begin the construction of a line.

AVALON, PA.—The Borough Council has passed an ordinance granting the Pleasant Valley Company the right of way over the New Brighton Road as far as the Avon Borough line.

ARCHIBALD, PA.—An ordinance has been passed authorizing the Archibald Street Railway Company to lay its tracks and operate its road on the streets within the borough limits.

BENNINGTON, VT.—The Bennington & Rutland Railway Company is considering the advisability of operating a five-mile branch between Bennington and North Bennington by electricity.

EAST ROXFORD, MASS.—The town of East Roxford has subscribed for $3,000 worth of stock in the Haverhill, Georgetown & Danvers electric road, providing it will extend through the village.

LAUREL, MD.—At a meeting of City Council, the Maryland & Columbia Railway Company was granted permission for the construction and operation of an electric railway upon certain terms.

PITTSON, PA.—The Pittson, Jenkins & Avoca Street Railway Company has received its charter, and it is the intention of the directors to build an electric line between Pittston and Moosic at once.

NEW HAVEN, CONN.—Vice-Pres. Hall, of the Consolidated Road, has stated that the Stamford & New Canaan branch, recently purchased, and about three miles in length, will be equipped with electricity.

BEVERLY, MASS.—The Lynn & Boston Street Railway Company has received permission from the Beverly aldermen to overhaul the tracks of the Old Beverly & Danvers road and equip for electric traction.

CORTLANDT, N. Y.—At a meeting of the Board of Trustees the Cortlandt & Homer Traction Company was granted an additional franchise for a track along Elm Street from Church Street to Pendleton.

PAINESVILLE, O.—The commissioners have granted a franchise to the Cleveland, Painesville & Eastern Railway Company on condition that the road be completed and operated by electricity within one year.

CLEVELAND, O.—It is reported that bids have been received by the I. C. Railway for equipping a large part of its system with electric motor power. The entire cost is estimated at between $3,000,000 and $4,000,000.

SEATTLE, WASH.—The Seattle Power Company has begun work on the electric plant which is to transmit the power of Cedar River to Seattle and Tacoma. It is stated that the work will cost $1,000,000.

NEW PHILADELPHIA, O.—The commissioners of Tuscarawas County have again advertised for proposals for a franchise for the construction of an electricrailway between New Philadelphia and the twin cities.

MERIDEN, CONN.—It is reported that the New York, New Haven & Hartford has bought the Meriden Electric, parallelling its line from Meriden to Wallingford, and which has taken a largeamount of its business.

OSHKOSH, WIS.—At Oshkosh the Central Wisconsin Electric Company has negotiated a loan of $300,000 to enable it to complete the local and interurban electric railway systems, and will ask an extension of franchise.

ISLIP, L. I., N. Y.—At a meeting held in Town Hall, the proposition to grant a franchise for a trolley system to Alexander B. Wailer, and Justice George B. Studley, representing a syndicate of Western capitalists, was approved.

WENHAM, MASS.—General manager E. E. Foster and Superintendent Page of the Lynn & Boston Railway have been in conference with the Board of Selectmen of Wenham in reference to equipping the Wenham line with electricity.

URBANA, O.—W. H. Hanford & Co., who were recently granted a franchise to operate an electric street railway over certain streets of the city, have left with the city solicitor a written acceptance of the conditions of the franchise.

NEW BRITAIN, CONN.—It is understood that the Street Committee has decided to grant the Central Railway & Electric Company permission to change its tracks and make such other improvements as asked for in its petition to the Common Council.

PITTSBURG, PA.—President D. F. Henry, of the Pleasant Valley Traction Company, has stated that if the company is given the right to build a belt line around Charles Street two routes will be arranged by which the extreme parts of Allegheny can be reached.

PINE BLUFF, ARK.—At a recent meeting of the City Council a committee of four aldermen was appointed to correspond with parties interested, with a view to the establishment of an electric street railway and a city lighting plant. The committee invites correspondence, communications to be addressed to Charles Weyl, chairman of the committee.

ELYRIA, O.—The City Council has unanimously decided to grant a franchise to James A. Mauldin, representing Cleveland capitalists, to construct an electric railway through this city, beginning at the southern limits. It will be extended to Lorain and North Amherst, making the second line to connect Elyria and Lorain. Work on the line is to begin at once.

HAGERSTOWN, MD.—The City Council passed an ordinance on Oct. 7, authorizing the Hagerstown & Potomac Street Railway Company to construct a street railway in Hagerstown. A special meeting of the Council was also held, to consider a franchise for a street railway for C. K. Kindred, and Z. P. Boyers and others comprising a Philadelphia syndicate.

ST. LOUIS, MO.—J. T. Houseman, the projector of the House & Air Line, otherwise known as the Baumhoff Electric Line, to Merrimac Highlands, now announces that he will build another and longer road in St Louis County. This will be a branch of the air line, and will start from the power-house at Brentwood and extend westward to Pacific, Mo., a distance of 40 miles.

WORCESTER, MASS.—At a regular meeting of the directors of the Consolidated Street Railway Company it was voted to petition the city government for authority to extend the tracks at Newton Square, 2,000 feet farther west over Pleasant Street. Heavy girder rails will be laid. The company will also extend the tracks at Quinsigamond village, farther over Greenwood Street.

SALEM, MASS.—The Lynn & Boston Company has fully determined to equip and run the old Salem & Danvers Road with electricity, and also to extend its electric power from Gloucester crossing in Beverly to Wenham. The Managers of the Haverhill, Georgetown & Danvers Road have announced that they shall build part of their line this Fall and the work will be begun very soon.

ONEIDA, N. Y.—The formation of the Central New York Light & Power Company has revived the question of constructing an electric railway from Oneida to Sylvan Beach on Oneida Lake. The new company has been consolidated with the old Warner Electric Light Company, capital stock of the new concern being $100,000. John W. Warner, Oneida; A. M. Young, Waterbury, Conn., and others are interested.

LANGHORNE, PA.—A new company, to be known as the Langhorne, Bristol & Newtown Trolley Company, recently formed at Langhorne, has obtained a charter, and work will be begun at once. The distance between Langhorne and Bristol is seven miles, and on the proposed route are six towns—Langhorne, Langhorne Manor, Eden, Hulmeville, Newportville and Bristol. At the latter place the line will connect with the proposed Philadelphia and New York trolley railway.

THE PECKHAM MOTOR TRUCK & WHEEL CO. has sent the Electric Railway Gazette a letter denying the charge recently made by a "so-called electrical journal," relative to the cost of repairs of its trucks used by the People's Passenger Railway Company, of Philadelphia. The Peckham Company encloses with its letter a communication from the People's Passenger Railway Company, stating specifically that the assertion that the repair expenses on the Peckham trucks were greater than were similar expenses for the maintenance of another make of truck used on the company's lines is absolutely untrue.

TRADE NOTES.

MR. EDGAR C. MOXHAM, of the firm of Hoefgen, Moxham & Co., New York, general dealers in street railway supplies, has returned from a very successful trip West.

EDWARD GRACE, vice-president of the Portable Hose Bridge Company, Detroit, Mich., while attending the Street Railway Convention, improved the opportunity by selling six portable bridges to the Montreal Street Railway Company.

SAWER, MANNING & CO., of 88 Franklin Street, New York, make a specialty of supplying cloth for uniforms which are used by the employees of some of the largest street railway companies in this country. The firm's cloths have been adopted by the Metropolitan Traction Company and the Manhattan Elevated Railway Company, of New York.

J. E. RHOADS & SONS, of Philadelphia, and Wilmington, Del., have just issued a new belting catalogue that will interest street railway men. In addition to the brands of leather belting produced in their own factory, the book describes a full line of rubber and other beltings, lace leather, belt fastenings, mechanical rubber goods, and specialties. We note among other items of special interest the Rhoads hand straps and tannate bell cord for street cars, which will well repay investigation by those interested.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., have lately completed for Wilmot & Hobbs, of Bridgeport, Conn., a new rolling mill building to take the place of the one recently destroyed by fire. The main mill is 126 feet wide and 200 feet long, with engine and boiler room attached, in a separate wing 54 feet wide by 90 feet long. The construction is entirely fire-proof, no wood being used about the building, so the risk from fire is absolutely eliminated. The roof covering is the Berlin Iron Bridge Company's patent anti-condensation corrugated iron.

W. S. DAVIS & SON, of Concord, N. H., have for over 25 years been before the public as builders of road equipment of all descriptions, and with the advent of the electric railway this firm was one of the first to introduce the tower and other wagons for general use in line construction and repairing. From the start this firm has commanded good business from the electric railway companies. Its list of patrons includes some of the largest corporations, and the orders it continues to receive from old and new customers argue conclusively that its equipment gives perfect satisfaction.

THE PARMENTER CAR FENDER COMPANY, 178 Devonshire Street, Boston, has secured the contract for the equipment of all of the cars of the Lowell & Suburban Street Railway Company, of Lowell Mass., with the Parmenter automatic counter-balanced life guard. The contract was given after most thorough tests and experiments with several fenders, covering a period of six months, which fact, together with General Manager Sullivan's endorsement that it is the best fender and wheel guard he knows of, and that it conforms strictly to the requirements of the Railroad Commissioners of Massachusetts, makes the order all the more gratifying to the Parmenter Company.

MR. J. H. GRAHAM, general manager of the Graham Equipment Company, of Boston, is greatly pleased over the very favorable comments elicited by his exhibits at the Montreal Convention just closed, most prominent among which was his steel frame for street cars, which does away with the present practice of building separate trucks and car bodies, the woodwork of the car being attached directly to the steel frame. This construction results in a very much lighter structure and appealed so forcibly to Superintendent Gunn and Master Mechanic Powers of the Toronto Street Railway Company, that these gentlemen opened negotiations for the right to build the Graham steel frames in Canada. The steel frame exhibited at Montreal was equipped with Graham spring-suspension and equalized brakes, which were highly spoken of on all sides.

Record of Electric Railway Patents.

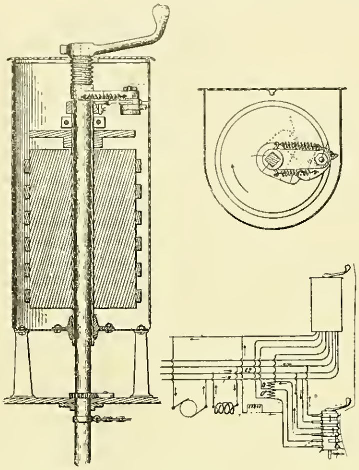
UNITED STATES PATENTS ISSUED OCT. 15, 1895.

547,733. STORM CURTAIN; George Manst, Philadelphia, Pa. Filed Nov. 15, 1894. A storm inclosure for car platforms consisting of standards extending from the dash upward to the roof, brackets adjustably located upon the standards and extending outward beyond the dash, a stretcher carried by the brackets, and a curtain connected with the roof portion of the car and extending downward over the stretcher, the lower edge of the curtain being secured at the dash.

547,761. STREET RAILWAY SWITCH; Irving W. Bliss, Warren, R. I. Filed Oct. 5, 1894. An automatic switch is operated by the car which rolls upon cams pivotally attached to the track. These cams operate levers which actuate the switch bars.

547,783. CONDUIT SYSTEM FOR ELECTRIC RAILWAYS; John Hartman, Philadelphia, Pa. Filed April 7, 1893. This is a conduit system with a slot normally closed by long, insulating pieces which carry conducting straps upon which the collecting wheel impinges and forces the whole piece down upon a live contact situated in the bottom of the conduit.

547,784. SUPPLY SYSTEM FOR ELECTRIC RAILWAYS; John Hartman, Philadelphia, Pa. Filed Aug. 7, 1893. The conduit system is divided into blocks or sections. The feed wire is in sections and is supplied with current by electromagnetic devices at the junction of each block. The return wire is permanently connected. Both wires have a separate slot in the same conduit.



NO. 547,847.—COMBINED ELECTRICAL AND MECHANICAL BRAKE.

547,834. ELECTRICAL TRANSMISSION OF POWER; William D. Baldwin, Yonkers, N. Y. Filed July 3, 1894. This is an electrical transmission of power system for tractive purposes in which a motor drives a generator, which in turn drives another motor. The driving motor has a constant field and the working motor is controlled by controlling the output of the generator automatically, and the motor circuits by suitable cut-out switches.

547,847. COMBINED ELECTRICAL AND MECHANICAL BRAKE; James R. Cravath, Chicago, Ill. Filed Aug. 10, 1895. In a combined electrical and mechanical brake, a cylinder switch is placed upon the brake spindle, which operates the electric brake, doing, thereby, the greater portion of the work. A chain on the end of the spindle in the meantime sets the mechanical brake, effecting a complete stop and locking the car on grades. The electric brake is operated by the motors that drive the car while they run as dynamos. (See Illustration.)

547,865. CAR-BRAKE; Enoch Prouty, Chicago, Ill. Filed July 26, 1895. In a car-brake a chain is wound upon a reel situate on the axle of the car, thus applying the brake shoes. The control of the chain reel is placed at the command of the motorman by means of suitable levers which throw in a clutch.

547,878. SWITCH OR CROSS-OVER SYSTEM FOR ELECTRIC RAILWAYS; Henry W. Brinckerhoff, Chicago, Ill., assignor to Carter H. Fitzhugh, same place. Filed June 13, 1895. This is a system for switching whereby a switch track has a movable section to gauge with either track which it connects. Each track is provided with conductors, and means to switch a conductor for the switch track in operative position only when required, by pivotally mounted standards actuated by an arm, is supplied.

547,889. CAR-REPLACER; John Ragon, Muldoon, Texas. Filed March 1, 1895. The car-replacer consists of an oblong, hollow skid, with suitable ridges on its upper surface and re-enforced by webs cast in the base, and designed to be positively secured to the rails to assist in running the derailed wheels upon the track.

547,914. SERIES ELECTRIC RAILWAY; Oliver B. Finn, Philadelphia, Pa. Filed March 29, 1894. This is a series electric railway system wherein obliquely-inclined shoes depress wheels supported at the side of the roadbed and hold the wheels down by means of a wire supported at the side of the car, thereby switching the car into series circuit with the generator.

547,931. INSULATOR FOR TROLLEY WIRE SUPPORTS; John W. Meaker, Evanston, Ill. Filed Nov. 19, 1894. The patent covers an insulator for trolley wire supports in which a conical piece of insulating material forming the support is forced into a conical sleeve by screw pressure, which also clamps the supporting wire. A bell-shaped piece is attached to the conical sleeve to deflect moisture from the insulator.

547,979. ELECTRIC HEATER; George W. Whittingham, Baltimore, Md., assignor to the Whittingham Electric Car Heating Company, same place. Filed July 15, 1895. A resistance coil is enclosed in a pipe surrounded by a heat-conductive medium and suitably provided with binding posts.

547,981. FARE-REGISTER; John B. Benton, New York, N. Y. Filed Feb. 24, 1894. A registering device, comprising two separate registers is operated by independent mechanisms to indicate two classes of fares, which can be arranged to work together if desired, a resettable trip register and a permanent record register. The register comprises two discs, one carrying unit numerals and the other tens and hundreds, a movable plate being arranged to uncover the hundreds numerals when necessary.

547,992. CAR-FENDER; Henry Hiestand, Philadelphia, Pa. Filed May 8, 1895. A woven wire fender is right-angled in section, with means for limiting the backward motion by suitable buffers.

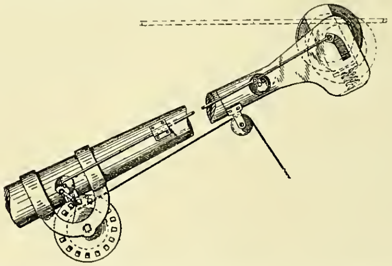
548,011. TROLLEY-WHEEL; Henry Schmidt, Moline, Ill. Filed Jan. 5, 1895. A self-lubricating trolley wheel has an oil chamber concentric to the shaft, rods or bars being placed at the opening in the journal bearings to support the lubricant. A chamber is formed around the shaft to confine all lubricant escaping from the lubricating chambers, and to hold it in direct contact with the friction surfaces.

548,019. CAR-FENDER; Albert J. Thornley, Pawtucket, R. I., assignor to the Consolidated Car-Fender Company, Providence, R. I. Filed June 26, 1895. This is a supporting and latching device for a car fender, in which one bell crank lever forces down another lever, both levers carrying jaws which confine the bars of the fender in the latch.

548,025. STREET-CAR BRAKE; Henry T. Atkinson, Oakland, Cal., assignor of one half to J. E. Morris, same place. Filed March 25, 1895. The patent relates to the combination of a hand-lever pivoted by means of links upon a short, vertical support on the car platform; a cam directly pivoted to the same support, a latch for engaging the cam, causing it to move as one with the lever, the cam winding up a chain which sets the brake.

548,032. SUPPLY SYSTEM FOR ELECTRIC RAILWAYS; Henry V. Brown, Brooklyn, N. Y. Filed Nov. 21, 1894. An electromagnetic device for rendering car tracks over which a car travels able to supply current thereto. Each device is thrown into action by current from the preceding device momentarily applied, catches being adapted to hold the connecting levers in contact and lock them out of contact as required.

548,070. ELECTRIC RAILWAY SYSTEM; John La Burt, Brooklyn, N. Y., assignor by mesne assignments to the La Burt Electric Railway Company, New York, N. Y. Filed June 26, 1894. The conduit electric railway system combines a multiple contact system bringing current to conductors normally free from it, and a rotary brush for cleaning the conduit during the passage of each car.



NO. 548,074.—COMBINED TROLLEY ROPE AND POLE CONTROLLER.

548,071. CAR-FENDER; John Landau, Brooklyn, N. Y. Filed May 21, 1895. The car-fender is supported from the dasher embraced by a spring surrounding a rod which applies the brakes when the scoop of the fender strikes an obstruction.

548,074. TROLLEY ROPE AND POLE CONTROLLER; Charles A. Lord, San Francisco, Cal., assignor of one half to T. A. Kirkpatrick, same place. Filed Jan. 9, 1893. Renewed Aug. 9, 1895. A trolley pole provided with a drum upon which is wound a trolley cord. A spring in the interior of the drum keeps a tension on the cord. The trolley wheel is forced upward by a small spring, which, when the trolley comes off, throws the trolley wheel forward, and, by means of a long lever, latches the drum and prevents the trolley from rising and engaging with the overhead construction. (See Illustration.)

Electric Railway Gazette.

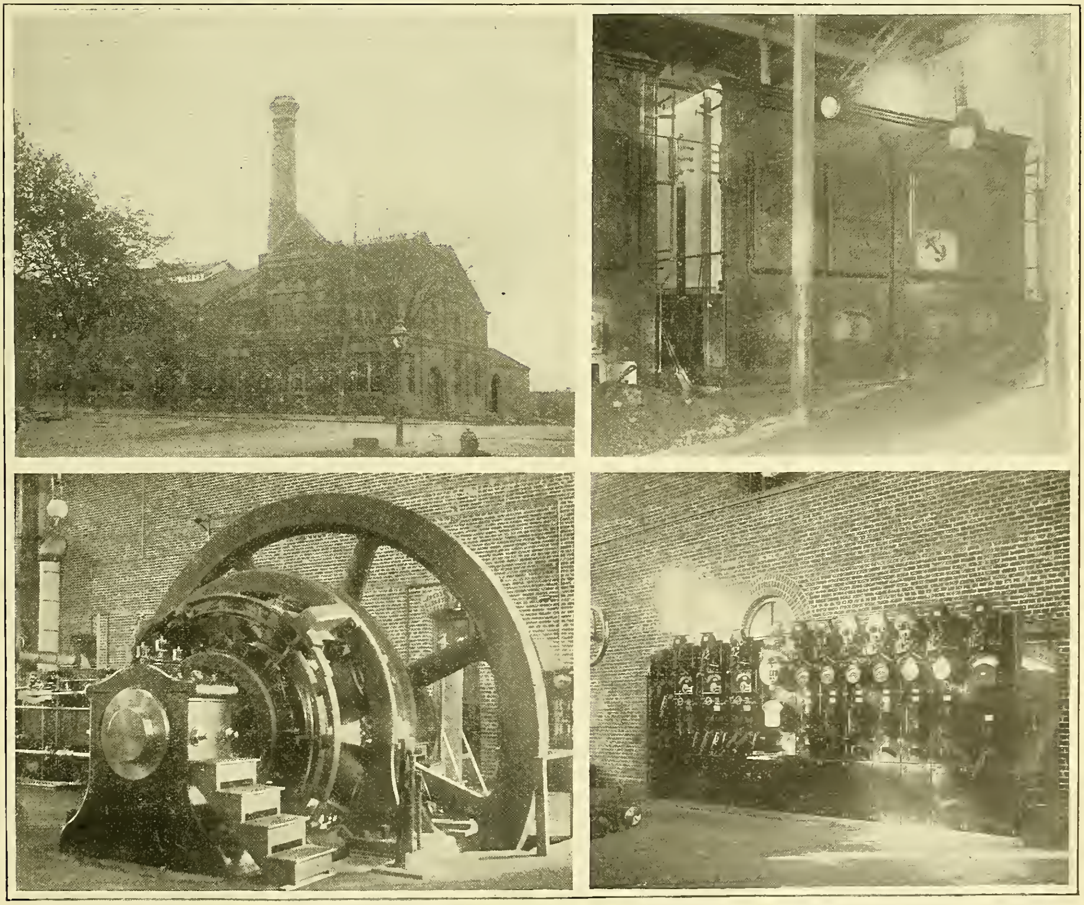
Vol. XIII. NEW YORK, NOVEMBER 2, 1895. No. 18.

Conduit Railway System of the Metropolitan Company of Washington.—I.

The Metropolitan Railway Company, of Washington, D. C., has made a persevering and conscientious effort to introduce an electric traction system which would not involve the use of overhead wires. The company made a prolonged trial of storage batteries, and did not abandon the attempt to make their use successful in practical operation until a vast deal of capital had been sunk in the enterprise. It was then decided to introduce a conduit system. Work was begun last Spring and was rapidly pushed to completion. For several weeks cars have been in operation, and the new system has already attracted the greatest amount of attention. Up to present time, at least, the success of the system has been so striking and promises to be so complete that a description of some of its characteristic features will be, it is believed, of no little interest.

The system was installed under the supervision of Mr. A. N. Connett, chief engineer, who can boast that he has acquired all the experience available in conduit railway construction. He has been connected with this class of work from the beginning, and was actively engaged in the construction of the first conduit railway system in Boston, which, it is said, was the second of the type in the country. The Metropolitan Railway Company has equipped with the new system, a stretch of track, which is four miles in length and double tracked.

The power station is situated rather disadvantageously at the extreme end of the line, but in spite of this, the maximum drop is but five per cent. or 20 volts. This argues the existence of an excellent feeder system. The power-house and car-barn are located on 4½ Street S. W.,



ELECTRIC RAILWAY SYSTEM OF THE METROPOLITAN RAILWAY—POWER STATION—BOILER ROOM—ONE OF THE GENERATORS—SWITCHBOARD.

between O and P Streets. No pains have been spared to make them attractive so far as architecture is concerned, and convenient in general arrangement. The construction throughout is most complete and substantial. The car-barn is large and high studded with a steel truss roof.

Several long pits for the inspection of cars have been built and are electrically lighted. The general illumination of the building is provided for by a large number of arc and incandescent lamps. The flooring is of artificial stone, and the only criticism that can be passed on the building is that it seems almost too good for the purpose to which it is put. A repair shop is located at the front of the building, and several machine tools are driven by a slow speed nine-hp General Electric multipolar-motor.

EXTERIOR OF CAR HOUSE.

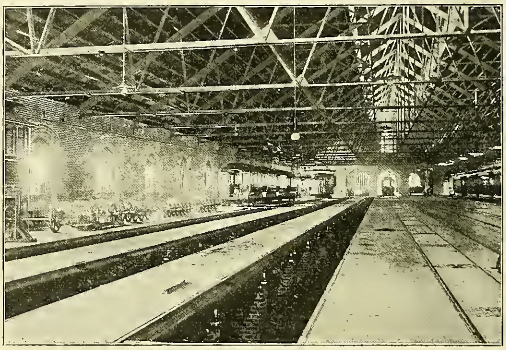
Conveniently adjoining the carbarns is the power-house. The boilers are of Zell water-tube type, manufactured by the Campbell & Zell Company, of Baltimore, Md. Of the three boilers two are banked into a battery. Potomac River water is used, and no trouble from boiler scale is experienced. At present the boilers are used one at a time, as each one is amply able to carry the load. They are rated at 250 hp each, at a working guage pressure of 120 pounds. The road is operating twenty-four trains of two cars each, and under this load the coal consumed averages 12,600 pounds daily. The coal economy of the station is remarkable, and reflects great credit on the management.

For 81,000 train miles, the station wattmeter indicated 168 e. hp. The coal consumed was found to be 3.66 pounds per e. hp measured at the switchboard per hour, and this, too, without deducting the coal consumed by a 9½ x 12 Armington & Sims engine, which runs the lighting plant from dusk to dawn, and all the power consumed by feed and air pumps. Moreover, as the units are running at a very light load, their full economy is not realized, and Mr. Connett confidently expects to lower the coal consumption when the lines have been sufficiently extended to give the engines an economical load.

There are three units in the engine room, and as they are identical the description of one of them will suffice. The engines are of the Greene automatic type, tandem-compound, and capable of exerting 400 i. hp.

Their dimensions are as follows : High-pressure cylinder, 17 inches, low-pressure cylinder, 32 inches, stroke, 48 inches. Each engine has a separate condenser and a Goubert feed-water heater. A supplementary heater receives the exhaust from the lighting plant and the steam and air pumps. No trouble has been experienced with the low-pressure piston, even at the high-piston speed of 728 feet per minute, necessitated by 91 revolutions per minute. This is partly due to the tandem type, as the low-pressure piston is accordingly provided with a tail rod. The flywheel was cast in two sections, which are linked together.

The engines are each directly coupled to a General Electric generator, the rating of which is M. P. 8–300–91. The voltage of the machines is 450 when running light, and 500 when loaded, and the current capacity is 600 amperes. It has been found, however, that with all the rheostat resistance in the field circuit the voltage is slightly over 525, and this has proved advantageous, as it has demonstrated that the conduit system can be successfully operated with this voltage. The economical performance of these units at less than half load attests their excellent design and good management. The armatures are of the drum type, the connections being carried around on the cylindrical surface instead of spirally in the plane of the heads. This makes a much larger armature, but one which admits of very ready repair.



INTERIOR OF CAR HOUSE.

The switchboard is substantially constructed. There are three machine panels, and in addition seven feeder panels and one instrument panel. Each feeder panel is supplied with an ammeter, a circuit breaker, and two single-pole single-throw switches. On the instrument panel is a heavy current recording wattmeter, an ammeter which measures the whole station output, a ground detector, and a low reading ammeter. The power-house has the same characteristics of good construction as the car-barn.

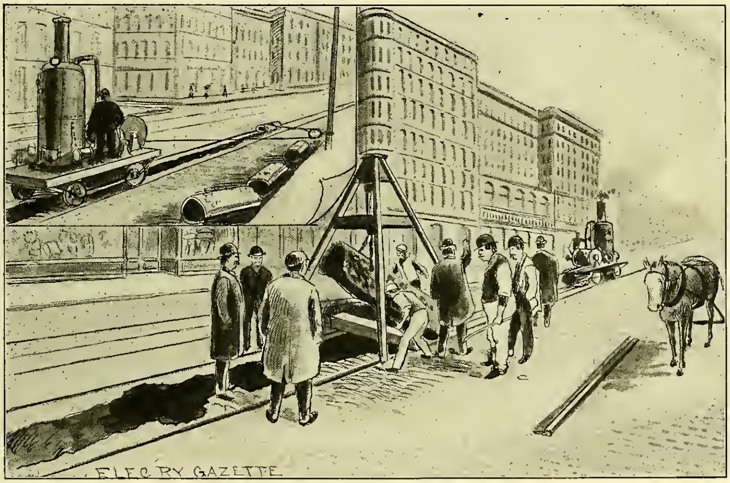
(*To be continued.*)

Objection to a New Rule in Toledo.

There has been talk of a strike on the lines of the Toledo Traction Company as a consequence of an order which has just gone into effect. The regulation to which the men take exception provides that each conductor must carry a cuspidor for use on the rear platform. This he must buy, keep clean and take back and forth with him when he leaves his car and when he resumes work. The men claim that the work which the new order involves was not what they agreed to perform when accepting positions.

Removing Cable Construction in Philadelphia.

The street railway companies of Philadelphia have pinned their faith to the overhead trolley system, and the indications that cable lines were once in operation in the city will soon disappear. Gangs of men are now employed in removing the old cable construction and the accompanying illustration shows the manner in which the work is performed on the old Market Street cable line. The work is prosecuted continuously day and night. The day force removes the paving blocks and excavates around the conduit down to the concrete in which it is imbedded. When the electric cars cease running at midnight the work of removing the conduit is begun. A derrick is raised over the track with a heavy block and tackle. A hook is inserted in a hole in one end of a section of the conduit, and the rope is carried out to the hoisting engine which is anchored to the track by means of chains. As the section is raised at one end ties are pushed under it, and the other end is raised above the tracks in the same way. The section is then drawn to the side of the street by a second engine, a rope from the windlass of which travels through a block attached to the nearest trolley pole.



REMOVING CONDUIT CONSTRUCTION.

The track-layers then begin work. New ties and heavy girder rails are laid, and the excavation is filled with concrete. Between two and three squares of the conduit are removed nightly, and the work is performed only during the hours when the cars are not running. The track-layers finish their task by the time the first car starts, at an early hour in the morning. The paving work, however, is done during the daytime.

The old conduit and metal used in the cable construction is carted away during the day, broken by steam hammers and thrown into the scrap pile.

The Market street cable road was built in 1884 and 1885, and was opened for traffic May 25, 1885. An issue of $750,000 bonds was made to defray the expense of the construction, which cost between $90,000 and $100,000 per mile.

The Philadelphia *Public Ledger* says of the obliteration of the conduit system : " Nobody has been heard to complain that the old system has passed into oblivion, though many men of an economical turn of mind refer to the utter destruction of what cost hundreds of thousands of dollars to build, and to assert that the money was thrown away. * * The delays caused by a break of the cable, a broken grip or some other accident characteristic of the road are still such recent happenings that passengers can easily recall the annoyances which they caused, and compare the smoothly-running trolleys with the old order of things, with great disadvantage to the latter."

Electricity on the Brooklyn Bridge.

The officials of the Brooklyn Bridge have requested the manufacturers of electric railway apparatus, to submit bids for an electric system for switching the cable trains at the terminals. The specifications call for the equipment of each train with electric motors of sufficient power to move the train from the point where it leaves the cable on the incoming track, to the point where the cable is gripped on the outgoing track. The overhead system will probably be employed, as the conditions are such that aerial wires can be strung at a small cost. One car of each train will be equipped with motors, and controllers will be located on the front and rear cars, so that the train may be operated from either end. During the trial of the electric system, the current for operating the motors will be taken from the trolley wires of the Brooklyn City Railway. The switching at the terminals is at present done by steam locomotives. During the busy hours of the day about seventy-five trains an hour are operated, and considerable time is lost in making connections between the trains and switching engines.

The adoption of the electric system will relieve the passengers of the disagreeable noise and smoke of the steam locomotive, and, it is believed, will greatly facilitate the handling of trains. The work will be pushed rapidly as soon as the contract is awarded. The construction of the new terminal stations is being prosecuted as fast as possible, and when completed, and the electric switching system is in operation, the inconvenience to which passengers are at present subjected will, it is believed, disappear to a very great extent.

The Right to Organize.

The hostile position which the Union Traction Company of Philadelphia, has assumed toward organized labor, has caused considerable discussion in that city of late. A conference to consider the matter was recently held by representatives of the Toynbee Society and the Woman's Union in the Interest of Labor. Several clergymen and college professors were present. It was decided to appoint a committee to investigate the question from an economic, legal and moral standpoint, with a view, if the case of the street railway employees should be sustained, of arousing public sentiment in favor of the right of the men to organize

Street Improvements.

BY R. D. FISHER.

There is little doubt of the power of a legislature to make the right of way of a street railway company subject to special assessment for the improvement, by paving, of a street in a city to the extent, at least, to which it is benefited by the improvement. But it is not so clear that it may authorize an assessment for an improvement which, from the nature of the property, cannot benefit it. (See Dillon Municipal Corporation, 761–768.)

Whether the legislature of a State has made property, situated as street railway property is situated, subject to special assessment for paving the street in which it lies, depends wholly upon what may be the proper interpretation of the statutes which are thought to give to a city the power to make such assessment. The first consideration incumbent upon courts is whether these statutes are to have a liberal construction or a strict construction. The elementary rule is that every statute which is in derogation of the right of property, or that takes away the estate of the citizen, ought to be construed strictly. Courts are disinclined to enlarge them by an equitable construction. (See Suth. St. Const. Sec. 363; 23 Am. & Eng. Enc. Law, 383.) The power to make local assessments is a part of the power of taxation. It is a sovereign power. It resides alone in the legislature. It can be delegated, but only by plain and unambiguous words. Statutes delegating such authority are usually construed strictly; nothing will be taken by presumption or intendment; and such statutory powers must be strictly exercised. (Suth. St. Const. Sec. 365.) The right to assess street railway property for street improvement must be affirmed by the city. It must produce express power in legislative enactment, and show that it has followed strictly every legal requirement. Any doubt or ambiguity arising out of the terms used by the legislature is usually resolved against the power.

Guided by the above principles of interpretation the statutes of a State which are claimed to be authority for the levy of an assessment for street improvement are to be tested.

Railway Property in Street.—In a recent case decided by the Wisconsin Supreme Court, the Board of Aldermen paved and curbed a certain street and charged a part of this improvement against a street railway's right of way and roadbed. It cited as authority therefor section 1836 of the Revised Statutes, which requires every corporation which owns or operates a railway in the street of a city to restore the street to its former condition, so that its usefulness shall not be materially impaired, and "thereafter maintain the same in such condition against any effects in any manner produced by such railway." The court said: "It would certainly require a very wild flight of imagination to discover in this statute any plain power to make a local assessment on the railway corporation to improve the street. The statute, in terms, only requires the corporation to "maintain the street, not to improve it." The Court also cited a section of the statute relating to general taxation, and especially to property exempt from taxation. It provides generally that "the track, right of way," and the other property named, belonging to the railway corporations, shall be exempt from taxation. This is followed by the following proviso: "Except that it shall be subject to special assessment for local improvements in cities and villages." Such a statute means as if the legislature had said "the track, right of way," and other property of railway corporations shall be exempt from taxation, "provided, nothing in this section shall be construed as exempting such property from local assessments for improvements in cities and villages." But the Court holds that this exception does not become operative to subject such property to assessment in the absence of other statutory provisions defining the case in which it is subject thereto, and describing the manner of levy.

Liability to Assessment.—In order to render a street railway liable for street improvements the cases must be defined and limited, as well as the manner of the assessment directed, before such property can really be made subject to such assessments. Hence, the real power to make such assessments, if it exists at all, is to be found in some other exercise of legislative power. As a rule, if it exists, it should be found in the charter of the city in which the road is maintained. Most States have laws giving power to the municipal legislature of a city to make street improvements, and to "charge the cost and and expenses thereof to the centre of the street to any lot, or lots fronting or abutting on such street." These are all the words to be found in many city charters which are claimed to give evidence of the legislative intention to subject a street railway company's right of way in a street to local assessments for paving the street. Such a statute, in words, gives power to charge the cost of the improvement only against "lots" which front or abut upon the street improved. Courts, as a rule, have insisted that they must at least be able to see in the words used a legislative intention to make a company's right of way liable to assessment. Even should the term "lot" include or be defined as "a strip of land," it is a wide stretch to claim that the term "lot" describes a company's right of way, with its roadbed and tracks wholly within the street, and not outside of it, and of indefinite length. Further, in such case, it is difficult to assume that this strip of land, even if it could be termed a "lot," fronts or abuts upon the street; for such right of way is wholly within and part of the street. It is safe to conclude that, by the use of the words, legislatures in a majority of the States have chosen, they had not intended to subject the rights of way of street railway companies, in cities thereof, to special assessments for street improvements. And, certainly, where it is not clear that the lawmaking power did so intend the same cannot be enforced. The weight of authority is largely against special assessments for improvements, for no duty rests upon a street railway company to pave or repave a part or the whole of a street occupied by it, unless the obligation is created by its charter or assumed by subsequent agreement resting upon a sufficient consideration. Where a corporation has made contracts, valid under the laws of the State at the time they were made, the State cannot unmake them, or impose other or different terms on the corporation, to its injury, and to the benefit of the other contracting parties.

The following States have statutory provisions requiring companies to pave their right of way: California, Civil Code, 1885, sec. 498; Georgia, Laws of 1891, p. 169; Iowa, Laws of 1884, p. 18; Nebraska, Comp. Stat., 1881, sec. 54, and Laws of 1889, p. 111; Ohio, Rev. Stat., 1890, sec. 2,504; District of Columbia, Supp. Rev. Stat., 1874–1891, U. S. P. 177, sec. 5. Much litigation has arisen out of the effort made by cities to enforce the liability to assessment, real or assumed, of street railway companies to pave or repave streets. This obligation depends upon the interpretation of the statute or ordinance prescribing the duty. In the absence of such a duty imposed by statute or ordinance, a company cannot be required to construct a new pavement on any part of the street occupied by a street railway.

Excursion to Ottawa.

When the delegation of street railway representatives made an excursion to Ottawa on Oct. 19, at the close of the Montreal convention they were cordially received by a committee of prominent citizens, and special cars were provided by the Ottawa Electric Railway Company to convey the visitors to the Parliament Buildings, where the formal reception took place. The particulars of the visit in Ottawa were presented in the Gazette of two weeks ago. In the Senate Chamber the premier, Sir Mackenzie Bowell, made a felicitous address, in which he welcomed the visitors. Lunch was served at the Russell House, after which the special cars were boarded. and the party was carried to the street railway company's park, two and one-half miles from the city, and thence to Chaudiere Falls, where the power station is located. The local street railway service was pronounced admirable, and the special cars were found to be extremely comfortable, heated as they were by electric heaters made by Ahearn & Soper, of Ottawa. A view of the cars which were provided for the excursionists is shown in the illustration. They are vestibuled, equipped with Westinghouse motors, and are mounted on trucks made by the Taylor Electric Truck Company of Troy, N. Y. The bodies were built by the Ottawa Car Company. A detailed description of the Ottawa system appeared in the Electric Railway Gazette of Sept. 14.

SPECIAL CARS IN OTTAWA.

Testing the Validity of the Brooklyn Speed Ordinance.

The Brooklyn Heights Railway Company has brought suit in the Supreme Court, against the city of Brooklyn, to secure an injunction restraining the municipal authorities from enforcing the speed ordinance. This measure was adopted in April last, and provides that "no street surface railway car, operated by electricity in any of the streets, avenues or public places in the city of Brooklyn, shall be run at a rate of speed to exceed six miles an hour within a radius of one and one half miles from the city hall, or within a radius of two miles of the Broadway ferries, nor in any other part of the first twenty-eight wards of said city, at a rate of speed to exceed eight miles an hour."

The complainant alleges that the Common Council had no right to pass the ordinance in question, as it is in violation of the terms of the grant of Jan. 11, 1892, which authorized the company to run its cars at such rate of speed as should enable it to secure better transit to the public, not to exceed ten miles an hour. The plaintiff alleges that an enforcement of the ordinance would injure the value of its property, franchises and privileges.

On the trial of the case Superintendent Newell, of the Broadway, New York, line, and Superintendent Robertson, of the Third Avenue, New York, line, testified that in New York they were allowed to run cars at a speed of from eight to twelve miles an hour. Daniel F. Lewis, ex-president of the Brooklyn Heights road, testified that since the regulating ordinance was passed the receipts of the road had decreased 10 per cent.

City Taxation of Cars in Pennsylvania.

Judge McPherson, at Harrisburg, Pa., last Monday, handed down a decision which is of unusual interest to street railway companies. The suit was brought by the City of Harrisburg against the East Harrisburg and Citizens' Passenger Railway Companies to obtain judgment for about $4,000, alleged to be due for 1894 taxes on cars. Judgment was ordered in favor of the complaint.

The companies were taxed $55 per car per annum, but they refused payment, on the ground that, even if the tax can be levied in respect to some of the cars, no cars are to be considered other than those which are in usual and ordinary use, and that no tax can be levied on any car, which was only put into service occasionally, to meet an unusual demand or to replace some other car, which was necessarily withdrawn for repair. It was claimed that the whole tax was void, and, therefore, no part of it could be collected.

With respect to the contention that only those cars in regular use can be taxed, Judge McPherson says no exception of this kind appears in the act of 1889, and the court has no power to insert it. "If good reasons exist," he adds, "for levying the taxation in proportion to the number of passengers which each car may have carried, or in proportion to the amount of money which it may have earned, or upon any other basis different from that which the act has adopted, they must be referred to the legislature as the only body competent to give them the effect which the defendant desires. How much a tax shall be and upon what subject it shall fall are matters of legislative discretion, controlled only by constitutional limitations, and lie quite beyond the province of a court. If a car has been used in the city during the year for hire or pay, the act expressly authorizes the city to tax it, and, so far as the courts are concerned, this is an end of the matter."

In the opinion of the Court, the act of 1889 authorizes a tax upon or in respect of each car, and not a tax upon the business or occupation in which the defendant is engaged. It was urged by the street railway companies that the ordinance taxing the companies provides a penalty for refusal to pay, and, therefore, that this remedy is exclusive. The Court says it would be absurd to suppose that the ordinance intended to permit a claim for nearly $4,000 to be satisfied by the payment of a fine of only $50.

With respect to the defence of the Citizens' Passenger Railway Company that its line stretches between two points in Swatara and Susquehanna townships, passing through the city on its way from one terminus to the other, and that the city cannot tax all the cars which are used upon its streets, but must be restricted to a tax upon a due proportion of the company's equipment computed according to its mileage within the city, the Court holds that both the commonwealth and city are exercising an undoubted legal right over a subject which is wholly within their power, and the reason for applying the mileage method disappears.

How Steam Roads Must Meet Trolley Competition.

Even the daily papers recognize the marked progress that the trolley system is achieving, especially in competing with steam lines for suburban traffic. The following is slightly condensed from an article which appeared in the New York *Sun* under the following headlines: "Trolley versus Steam"——"Some Effects of the Competition of Electric Roads"——"In Some Instances the Steam Railways' Local Business Has Been Affected More than 50 Per Cent."——"Electric Roads Flourish Most in the Summer."

"No stronger evidence is needed as to the importance of electric railway competition in the field of transportation than the efforts of the management of the New York, New Haven & Hartford Railway to secure legislative interference for the protection of its interests against the rapid encroachments of parallel electric roads on its local passenger traffic," said an electrical expert. "It was shown in the argument presented that the steam railway had lost in local traffic between certain points from 50 to 100 per cent. of its receipts. Probably very few of the most enthusiastic promoters of electric railways would have predicted such an amazing result as is shown in this statement. The steam railway has been looked upon as a thoroughly entrenched and perfectly managed institution, which might occasionally be subjected to annoyance by the street railway, but the idea of permanent financial injury by so insignificant a rival appeared absurd in the extreme. Steam railway managers in thickly settled territory must now face the question, whether it is better to abandon local passenger traffic, or retain it by the construction of electric railways. The advantages of boarding a trolley car at the next corner, and the very general adoption of the transfer system, are features of value which are attractive to the masses. In Summer the open car is an additional incentive, and the entire absence of smoke, gas, steam, dust and cinders invites patronage; so that we find an actual increase of passenger traffic due to a desire for cheap open-air excursions.

"Upon the steam railways, on the contrary, Summer trips are regarded as anything but enjoyable in the stuffy cars usually provided, where smoke and cinders make their disagreeable presence manifest. Steam railways which have long enjoyed a monopoly of transportation between large cities and neighboring popular resorts are likely to lose their business altogether, unless they take advantage of their superior roadbeds and at once equip their lines with electric motors, as in the case of the Nantasket Beach Railway. Another season should not be allowed to pass without the abandonment of steam upon every short line warranting frequent trips to an excursion or Summer resort.

"Experience has proved that there is a limit in the weight of passenger trains, which it is not advisable to exceed, therefore the tendency hereafter would naturally be toward more frequent trains. It is apparent to every student of this problem, therefore, that increased traffic must gradually bring the passenger service of a steam road nearer and nearer to the conditions which favor the use of electricity.

"The first thing for the railway manager to do is to accept the inevitable and admit that the electric motor is a good machine. Having done this, he should endeavor to see how it may be utilized for the benefit of his own system, without waiting for some enterprising trolley company to steal a march upon him and honeycomb the local business.

"It is not alone in passenger traffic that there is likelihood of substitution of electricity for steam. Experiments have lately been made in electrically hauling of freight. These experiments have been in the main successful, though directed toward the system of hauling enormously heavy trains, rather than the unit system. For the present, at least, development seems surer, however, if the unit method is cultivated and cars are run at frequent intervals, rather than in long trains at greater intervals.

"These two widely separated types of electric locomotion have been brought forward this year in the experiments on the Nantasket Beach branch of the New York, New Haven & Hartford road, and the work in the Baltimore tunnel.

"The opinion is general among electrical engineers that electricity will occupy certain fields; namely, all city railways, whether on, above or below the surface; also suburban service within certain limits, and interurban service between cities and large towns when not too far separated.

"There is one branch of railway service to which the electric motor seems particularly well adapted, and that is the city elevated roads. In this service the great requirement is flexibility of speed. The trains are never operated at full speed, on account of the frequency of the stations.

"Rumors have been current for a long time that a change from steam to electricity on the city elevated roads was a probability of the near future. The absence of noise, smoke and cinders would be appreciated by New Yorkers, and the officers of the elevated road would find in electricity a means of regaining the traffic which has been diverted to the surface cable roads."

Fire at the Laconia Car Works.

Fire broke out for the third time in four years in the plant of the Laconia Car Company, of Laconia, N. H., on Oct. 28. The setting-up shop, the pattern-shop, several small buildings and a number of cars were burned. The loss is about $50,000, and is covered by insurance. The more valuable buildings, which are constructed of brick, were not injured. Rebuilding will commence at once.

Payment For Services in Securing a Franchise.

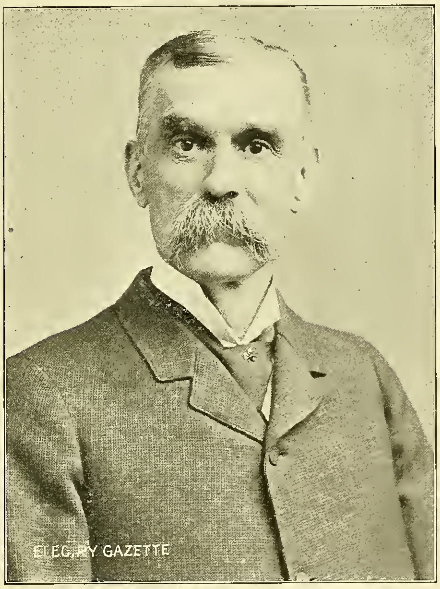
The referee in the suit of Matthew R. Breen and Daniel F. Cohalan against the Union Railway Company, of New York, has made a report giving the plaintiffs $25,000. They claimed $100,000 in payment for their services in securing a franchise from the legislature for the defendant company.

Street Railway Engineers—XXIII.

S. J. MACFARREN.

One of the best-known street railway engineers in the Pittsburg district is Mr. S. J. Macfarren, M E., vice-president and manager of the Schenley Park & Highlands Railway and the Homestead & Highlands Railway Companies. He has been engaged in engineering work for a great number of electric railway companies, and has achieved marked success in these enterprises. He was born in 1842, at the parsonage of Congruity, a hamlet in which his father occupied a pulpit for 42 years. The little town was located on the old northern turnpike and stage route between Pittsburg and Philadelphia, and is midway between Saltsburg and Greensburg. The former place is situated on the canal, and his first trips to Pittsburg, consequently, were made by water. Greensburg, since that time, has become a station on the Pennsylvania Railway.

As a boy Mr. Macfarren saw the first construction on the magnificent system of steam roads in Pennsylvania, and the interest then excited in this class of work has always remained with him. He received his education at the academy at Eldersridge and at the college at Washington, Pa., leaving the latter institution at the close of his junior year, to accept a position in the warehouse of an uncle. A year later, 1862, he enlisted as private in Company F, Fifteenth Pennsylvania Cavalry, and served in that and other regiments in the Armies of the Cumberland and Potomac until he was mustered out of service, in 1865, as lieutenant of Company I, Third Pennsylvania Cavalry. He again accepted a position with his uncle, and for several years was employed as a commercial traveler. He inclined, however, toward mechanical pursuits and became the head of the firm of Macfarren, Levy & Co., of Chicago, which manufactured lathes and machine tools. All this time however, he was greatly interested in in railway work, and during the International Railway Appliance Exposition in Chicago, in 1883, he became an eager student of all the new devices and methods. Soon after he accepted a position as superintendent of construction for the Iron Mountain Company in Durango, Mexico, where blast furnace and machine shops were located. He remained in this position for some years, during which he made earnest, though ineffectual attempts to promote railway connections so greatly needed then, and since supplied by the Huntingdon system. Returning to the United States he devoted himself to practical work in electric traction, the beginning of which he had seen in the performance of the Field locomotive in the gallery of the old Exposition building in Chicago in 1883.



S. J. MACFARREN.

He has since that time been busily engaged in this field as promoter, financial agent, contractor, manager and engineer. Among the railways with which he has been connected are the following: Suburban Rapid Transit Company, Braddock & Turtle Creek Railway Company, White Electric Traction Company, Schenley Park & Highlands Railway Company, Homestead & Highlands Railway Company, the Passenger Railway Company, of Altoona, the Cumberland, (Md.) Railway Company, and the Martinsburg, (W. Va.) Railway Company. He is consulting engineer of the Buffalo & Niagara Falls Electric Railway Company and of several other well-known companies. He equipped the Beaver & Ellwood Railway with an electric system for passenger service without interfering with the freight traffic by steam locomotive. This was a pioneer installation in this field. Mr. Macfarren has contributed valuable information by papers and in discussions at the meetings of the American Society of Mechanical Engineers and the American Street Railway Association. The fact is worthy of remark that the opinions which he expressed years ago in such papers as "Street Car Gear for Modern Speeds," and "Common Sense in Rapid Transit" have since required no modification, but hold good to-day. His ripe experience, prompt decision and practical mechanical knowledge have proved invaluable in the varied enterprises with which he has been identified.

Trolley Lines on the New East River Bridge.

The greatest interest has been manifested in Brooklyn in the plan of the commissioners of the new East River Bridge to permit Brooklyn electric cars to cross the structure. The commissioners have assumed that the Brooklyn railway companies would offer a considerable sum for the franchise, as it was argued that by crossing the new bridge the cars would secure a vast deal of traffic which they do not now obtain. The street railway officials, however, do not appear to look at the matter in the same light. They met the bridge commissioners at a conference this week and President Rossiter, of the Brooklyn Heights Railway, assured the latter that, so far from paying for the privilege, he thought the companies should be allowed to collect fares of bridge passengers, as he could see no advantage that would accrue to them, although he thought the plan was one calculated to promote public convenience. It is announced that the elevated companies of Brooklyn stand ready to pay liberally for a franchise permitting them to cross the bridge, as they would, beyond all doubt, secure by such a plan, a great deal of traffic that would otherwise go to the surface lines. The franchise question must be settled before the plans of the bridge can be definitely determined upon and construction begun.

ELECTRIC RAILWAY GAZETTE

AN ILLUSTRATED WEEKLY RECORD OF ELECTRIC RAILWAY PRACTICE AND DEVELOPMENT.
Established January 1, 1886.

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As THE ONLY PUBLICATION in the world DEVOTED TO THE ELECTRIC RAILWAY INDUSTRY, and the only journal adequately treating THE NUMEROUS TECHNICAL FEATURES INVOLVED IN ITS MODERN DEVELOPMENT AND PRACTICE, the ELECTRIC RAILWAY GAZETTE aims worthily to represent the activity and progressiveness of the important interests to which it is devoted. Presenting ALL THE NEWS EVERY WEEK, and describing CURRENT IMPROVEMENTS AND DEVELOPMENTS immediately upon being brought forward, its pages offer to those engaged in the electric railway field the TIMELY ADVANTAGES ENJOYED IN OTHER ACTIVE AND IMPORTANT BRANCHES OF MODERN INDUSTRY, and to advertisers A LIVE AND ENERGETIC MEDIUM commensurate with their needs and one giving CLOSEST ACCESS TO THE COMMERCIAL OPPORTUNITIES OF AN EXTENSIVE AND GROWING BUSINESS.

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TAXATION OF CARS.

A decision which has just been handed down by a Pennsylvania court bears very heavily on street railway companies in the State. Two companies sought to escape the payment of onerous local taxes levied on their cars on the ground that it was manifestly unjust to tax all cars owned by a company regardless of the fact that they might not have been operated continuously. The court found that the statute provided for no discrimination of this kind, and ordered judgment for the entire amount of the claim for unpaid taxes. Such a decision may be, and doubtless is, good law, but it certainly does not appear to be justice. It seems manifestly unjust that a company operating closed cars for six months and open cars for six months should be compelled to pay a yearly tax on both equipments, especially if the same trucks and motors are used for both kinds of car bodies. Such a statute is certainly directly opposed to the interests of the public, as under its provisions it is obviously to the advantage of companies to reduce their car equipment to the minimum, and to disregard altogether the popular preference for open cars during the summer months. To secure the repeal of such a manifestly unfair law ought to afford an excellent opportunity for the display of activity by the Pennsylvania State Street Railway Association. As we understand it, that organization proposes to engage in more vigorous work than it has yet attempted, and there is no likelihood that, under existing conditions, it will soon finish its labors.

CONDUIT SYSTEMS.

That the conduit system is attracting a vast deal of attention from street railway men at the present time cannot be doubted. Many of them realize fully that when the success of such a system is thoroughly demonstrated, franchises for overhead wires will be extremely difficult to secure. Some companies, those in Chicago, for example, have obtained the right to string wires overhead only upon the express condition that they shall be removed when a practicable system of conduit roads shall have been developed. Beyond all doubt, cable companies, in a number of instances, are already considering the advisability of substituting wires for cable ropes in their conduits. A report from St. Louis, printed elsewhere in this issue, announces that this substitution will be made on one of the roads in that city if the tests of the lines now operated by underground conductors indicate that success is as attainable during the Winter months as during the Summer and Autumn. On the other hand, Philadelphia gives evidence that it will have nothing to do with the conduit system. Its companies express themselves as perfectly satisfied with the overhead trolley system, and are uprooting the old cable construction as rapidly as possible. Their action would seem to indicate the conclusion that the adaptability of the cable conduits for the reception of electric railway wires is regarded as a fact of no significance whatever. There are two conduit lines now in regular operation—one in New York and the other in Washington. A third road constructed for experimental purposes by the Third Avenue company of New York, will probably be completed within a few weeks. It is satisfactory to realize that these three roads, are under the control of operating companies, and that they can be influenced in no respect by commercial consideration to make the results appear more favorable than they actually are. After the tests during the adverse conditions of Winter weather, figures will be obtainable that may be regarded as reliable. If the success of the installations is as marked as has been confidently expected in some quarters, the number of conduit roads built within the next two years will probably not be inconsiderable and it cannot be doubted that success will point to the beginning of the end of the cable system.

ELECTRIC TRACTION ON THE BROOKLYN BRIDGE.

The decision of the authorities of the New York and Brooklyn Bridge to introduce an electric railway system for switching the cable trains in the terminal stations is generally assumed to mean more than appears on the surface. That the new system will be successful and a great improvement on the existing method which involves the use of steam locomotives is questioned by no one, least of all by the Bridge engineers. They see in the application of the electrical system an opportunity to save the seconds now lost in coupling the engines, and economy in time is a consideration of the utmost importance in a railway on which trains, when running on less than a minute headway, are unable to meet the demands of the public during the busy hours. It is not believed that in their effort to meet the extraordinary demand for transportation to and from Brooklyn, the commissioners will stop at the introduction of the new switching system. This improvement will unquestionably lead to a still greater one—the substitution of electricity for the cable on the Bridge railway. It cannot be denied that the cable system, now in operation, performs excellent service. The conditions are peculiarly favorable to the success of a cable line ; it is a simple, straight road ; no curves whatever are encountered, and the traffic is unusually heavy. At the same time, the cable cannot compete with an electric traction system, and it cannot be doubted that the substitution of the latter would in every way prove advantageous. Greater speed would be attainable, the liability of a break-down would be decreased, and the cost of operation would doubtless be less. The introduction of an electric system could easily be effected on the Bridge. When the existing system for the electric illumination of the cable cars was installed, an overhead system, unusually substantial, was provided. The work was so thoroughly done and the conductor for carrying the lighting current was so large in section that it was surmised by some persons that the installation was made with a view of using the overhead wires eventually for traction purposes. The conditions are certainly favorable for making a thorough test of electric traction on the Bridge. In arranging for the new switching system the trains will be equipped with electric motors, and the wires of the present illuminating circuit will carry the current, which will be obtained from one of the Brooklyn railway plants. There will be nothing to prevent the operation of a train from terminal to terminal after the cable has ceased to run at night. There appears to be no question that this is the present purpose of the Bridge authorities, and doubtless the tests will point to the advisability of abandoning the cable system.

Boston Subway Work to Proceed.

The work on the Boston rapid transit subway is not to be delayed at present by a writ of injunction. A decision to this effect was made by Judge Holmes in the Equity Session of the Supreme Court in Boston a few days ago. The case came before the Court on the question of a demurrer filed by the City and the Rapid Transit Commission to the bill of complaint of several taxpayers who brought suit to stop the subway construction. The complainants alleged that the Subway Act was unconstitutional. The Court reserved the case for the full bench. It is not likely that a decision will be reached before Jan. 1, and in the meantime the work will proceed.

Conduit System Considered in St. Louis.

Mr. Charles Green, of the People's Railway, of St. Louis, recently visited Washington to investigate the conduit system installed by the Metropolitan Railway Company of that city. Mr. Green has always been an advocate of the cable system, but when asked on his return to St. Louis concerning the merits of the electric conduit system he said he was favorably impressed by it, especially as it could be readily adapted to existing cable construction. When asked if he intended to reconstruct the People's line according to the Washington method he said that he expected he would do so if the Washington system stood the test of the Winter. If it proved to be impervious to the action of frost and snow, he considered it the coming system of the country for street cars. He saw nothing in the way to prevent the adoption of it in St. Louis.

Connecticut Electric Railways.

Reports from the Connecticut electric railways show generally a large increase of business over last year, which is particularly marked in the lines running to the seashore. Nevertheless, there is a singular stagnation in new construction, says the New York *Evening Post*, and at the present time hardly a mile of electric road is building out of new ones chartered over distances of not less than 400 miles altogether, of which a large proportion is in the cities. The check on construction is attributed to several causes, among them—besides exhaustion of the most promising territory—the disposition of the cities and towns to tax new roads, if laid out on streets or highways, the growing opposition to surrendering country highways at all, and the electric plans of the New Haven Railway Company, which affect several important centres where large extension of electric service had been meditated.

An Extensive Railway System.

The Buffalo Traction Company was incorporated on Monday last. The company proposes to construct an electric railway 66 miles in length. The road is to be constructed from the Buffalo city line at South Park, and from the city ship canal in the Hamburg Turnpike to the Buffalo city line in O'Neill Street, and across the City of Buffalo to the Pine Hill road in the town of Cheektowaga, which places will be its terminal. The capital is $3,000,000, and the directors are E. G. S. Miller, Joseph B. Nayer, Leonard B. Crocker, Washington Bullard, and Herbert P. Bissell of Buffalo, Tom L. Johnson of Cleveland, O., Richard Ladenberg, John K. Page. and Louis Kahn, of New York City.

Electric Car Tests.

BY HERMANN S. HERING, M.E.,

Assisted by

CHARLES REUTLINGER and B. HARRISON BRANCH.

(*Continued from page 320.*)

V.—PERFORMANCE OF CARS RUN OVER THE ENTIRE ROUTE.

The tests just described were limited to uniform grades and steady speeds, but in order to approximate the conditions of actual service and to determine the difference between cars run on express time and in regular service, and also the difference between various cars run under similar conditions, the cars were run over the entire car route of the two roads in these various ways.

The cars used in these tests were the same as those used in the previous tests with the exception of car No. 31, which was a double-truck car equipped with No. 16 Edison motors, and also car No. 314, which was equipped the same as No. 234. A cable car and a horse car were also used in a portion of the test in order to obtain a comparison of their characteristic operation.

Car No. 234 with the Westinghouse equipment, Car No. 64 with the General Electric equipment, and Car No. 31, the double-truck car, with Edison equipment, were run on the Pikesville road of the Baltimore Traction Company and also on the Roland Park road of the Lake Roland Elevated Railway Company under as nearly the same conditions as possible. They were operated by careful motormen, and the orders given them were to run over the road on express time, making no unnecessary stops. The motorman who is accustomed to run his car on a certain road is of course at some disadvantage in running that car on a strange road, but this happened with both the Pikesville car, which was run on the Roland Park road, as well as with the Roland Park car, which was run on the Pikesville road. In the case of the Roland Park car running on the Pikesville road, however, there were very few portions of the road where the controller had to be thrown off, or the brakes applied, but in the case of the Pikesville car on the Lake Roland road comparatively frequent stops were necessary, and lack of familiarity with the roads was a more important consideration.

The cars were equipped, as in other tests, with a Boyer speed recorder, portable Thomson wattmeter, and Weston ammeters and voltmeters. The instruments were all calibrated at various times and the corrections allowed for. The readings of the ammeter and voltmeter were

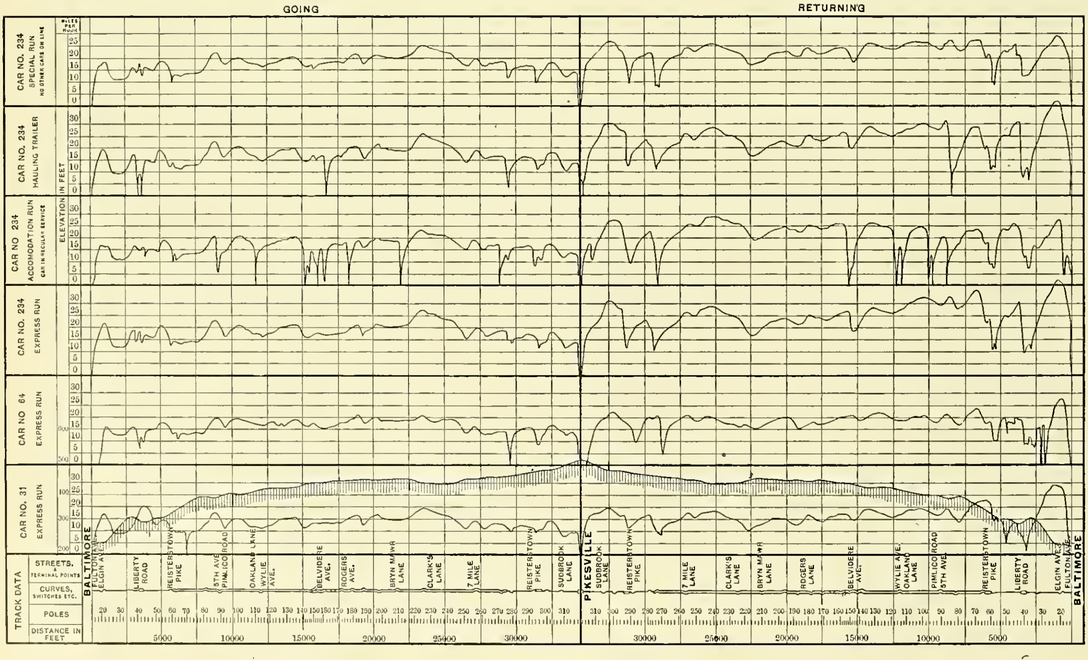


FIG. 29.—COMPARATIVE SPEED RECORDS OF VARIOUS ELECTRIC CARS

RUN ON THE PIKESVILLE ROAD.

Car Equipments: No. 234, Baltimore Traction Company, two 25-hp No. 3 Westinghouse motors; "G" controllers; single truck, "Bemis." No. 64, Lake Roland Elevated Railway Company, two 25-hp "G. E. 800" motors; "K" controllers; single truck, "Lord Baltimore No. 2." No. 31, Lake Roland Elevated Railway Company, two 25-hp No. 16 Edison motors; "K" controllers; double truck, "McGuire."

DETAILED DATA IN TABLE 10.

however, not always taken and were not plotted for these tests owing to the fact that the work involved would have been entirely too great and the curves too elaborate and complicated. It was deemed sufficient to compare these various runs by means of the watt-hours consumed per trip and per car-mile, and also by means of their speed records. The observations made on these tests were the time of leaving and arriving, and the delays; the readings of the wattmeter at the beginning and end of each trip; the number of stops and the number of passengers. The results obtained give the exact time interval, mean speed, total watt-hours, the watthours per car-mile and the electrical horse-power. All these were determined for the out-going trip, the return trip and the entire round trip.

Pikesville Road Tests.—Table 10 contains, in the first portion, the results for each trip of these comparative tests made on the Pikesville road; the speed records of these tests are shown in Fig. 29, where they are plotted on the track data as a base. These curves were taken directly from the autographic records of the Boyer recorder, and the scale was corrected to agree with the calibration. The plot of the track data contains, on a scale of distances, the poles, curves, switches turnouts, single and double track portions, and the names of the principal stations along the road. It is plotted for the entire round trip for the sake of clearness; the car is assumed to pass from left to right across the page, and is therefore supposed to run on the lower one of the two tracks plotted on each half of the diagram, which will be the same as though it had passed from left to right on the lower track to Pikesville, and returned from right to left on the upper track. The first four records from the top are those obtained with car No. 234 when run under different conditions. The first is the special run which was made when there were no other cars on the road; it is the same record as that used in Figs. 17 and 18, and is put here simply for the sake of comparison. The second curve is that obtained when the car was hauling a trailer. The third is that of a typical accommodation run obtained from the car while in regular service, and shows the characteristic operation under those circumstances. The fourth is an express run in which the car was run over the round trip at the best possible speed. The data for these runs is given in Table 10, from which the running time, speed and watt-hours can be obtained. The difference in the watt-hours required for the first and fourth tests, which is about 6 per cent., is due to the difference in the manipulation of the controller, as the other conditions were practically the same. The value of the mean speed calculated from the time interval and that obtained from integrating the records, do not always agree, as has been previously explained, but they are both given here in order that either may be taken; where the number of stops is larger the difference between the two becomes greater, owing to the error in the time reading and that due to the stopping and starting.

The last three records in Fig. 29 show the runs of the three test cars when operated on this road on express time; the speeds in each case were very nearly the maximum. The voltage on the line in the case of the last two records was a little lower than the others, but the difference was not very great. The data for these runs is also given in Table 10, and a comparison of these various conditions will be found to be very interesting. Many of the causes for the variations in speed can be seen by referring to the profile and track data on which the records are plotted.

Lake Roland Road Tests.—Fig. 30 shows the speed records of the tests made on the Lake Roland road with the same cars and under the same conditions, as on the Pikesville road, and the results are given in the second and third portions of Table 10. The tests made on the Lakeside route were distinct from those on the City Hall route, because of the different character of the roads, the Lakeside route being fairly well built and having many curves of large radius. The track data is given in the same way as in the other sheets, and the car should be assumed to be running on the lower track throughout, in which case the relative direction of the track curves will be correct.

The first four records are those obtained from the Lake Roland Car No. 64 when run under the different conditions, which were the same as those under which the Pikesville car was run on the Pikesville road, Fig. 29, and the last three records are those obtained from the same three cars, run on express time, as were used in that test.

The first record is that obtained from the special run made for the test plotted in Figs. 22 and 23, and is repeated here for comparison. The fourth run was made by the same motorman, and at about the same date that the fifth and sixth runs were made. The speed is considerably greater, though the number of stops is practically the same, but the motorman did not make the first run at maximum speed, attempting merely to run at the regular speed, and it is remarkable how closely the first and third runs agree; in the fourth run the motorman ran the car at the maximum speed, as also in the fifth and sixth runs; therefore these three runs are comparable. The third run is a typical accommodation run obtained from the car while in regular service, and shows what the usual values of such a run are. On the Lakeside route the speeds were much higher and the watt-hours per car-mile considerably less, due mainly to fewer stops and better track construction.

In order to eliminate the difference in weight between the cars, the electrical horse-power and watt-hours per ton of car weight and per ton-mile, were computed, and are given in Table 9 as an appendix to Table 10.

Many interesting points can be obtained from a careful study of these results and a comparison of the speed records. The object of this test was not to criticise the cars nor their operation, but to furnish some empirical data for these conditions, which may be useful to those interested in electric traction work. Criticism can, however, justly be made of roads not built according to the best modern engineering practice, and also of careless and wasteful handling of the controller, and these features are alluded to in this article.

Sundry Road Tests.—Fig. 31 contains the speed curves of cars run on several of the electric roads of the Baltimore Traction Company, which show typical city running. These records were all obtained directly from those of the Boyer speed recorder, with suitable corrections for the calibration. During these tests readings were taken of the time, location, watt-hours, number of passengers, number of stops, etc., and the runs are all those of cars in regular service or those operated as nearly as possible equivalent to regular service by running, for instance, a few hundred feet behind a regular car and making the same stops. The data is given in the fourth portion of Table 10.

The last two records in Fig. 31 are those obtained from a cable car and a horse car, and were placed here in order to show the characteristic differences of speed and operation.

The horse car record was obtained from one of the horse cars, a driver, and a pair of horses which had been accustomed to run over this route only a few months before. The car was run over the route after midnight and stops made that would be a fair average of those made by the cars in regular service, and the speed of the car, excluding stops, was about the same as formerly made by the horse cars on that road. The record can be compared with the fourth record in this series, which was obtained from an electric car running over this same line in regular service.

TABLE 10.—OBSERVED AND COMPUTED RESULTS OF THE PERFORMANCE OF VARIOUS ELECTRIC

SPEED RECORDS AND TRACK DATA PLOTTED IN FIGS. 29, 30 AND 31.

ROUTE.	CAR NUMBER.	CONDITIONS UNDER WHICH OPERATED.	DATE.	GOING.														
					TIME.				Mean speed miles per h.					STOPS.				
				Distance going.	Leaving.	Arriving.	Delays.	Net time interval.	Calculated from time interval.	Integrated.	Watt-hours from watt-meter.	Watt-hours per car-mile.	Mean E. H. P. from watt-meter.	Full.	Partial. (3 m. p. h. or less).	Total.	Passengers.	Total weight, car and load.
1	2	3	4	5_o	6_o	7_o	8_o	9_c	10_c	11_c	12_o	13_c	14_c	15_o	16_o	17_o	18_o	19_o
					H. M. S.	H. M. S.	M. S	H.M.S										
BALTIMORE AND PIKESVILLE. (From Fulton Ave., pole 15).	234	SPECIAL RUN. No other Cars on Road.	June 8, 1894	6.52	3 55 0 A. M.	4 18 15 A. M.	....	23 15	16.8	17.3	6890	1056	23.81	1	0	1	10	17313
	234	HAULING TRAILER No. 154.	Aug. 21, 1894	6.5	9 32 15 A. M.	10 3 30 A. M.	4 44	26 31	14.7	16.2	7942	1223	24.08	4	1	5	5	22480
	234	ACCOMMODATION RUN. Car in Regular Service.	Nov. 3, 1894	"	2 3 0 P. M.	2 32 0 P. M.	2 10	26 50	14.5	15.3	7510	1156	22.50	7	1	8	14	......
	234	EXPRESS RUN.	June 4, 1894	"	4 19 30 P. M.	4 44 35 P. M.	....	25 5	15.6	17.6	6822	1050	21.90	1	0	1	11	17385
	64	EXPRESS RUN. (From pole No. 19.)	May 31, 1894	6.4	5 57 0 P M.	6 28 30 P. M.	6 10	25 20	15.2	15.4	7417	1158	23.51	2	0	2	6	15615
	31	EXPRESS RUN.	June 18, 1894	6.5	1 57 0 P. M.	2 27 35 P. M.	0 19	30 16	12.9	12.6	10470	1610	27.82	2	0	2	13	23760
ROLAND PARK AND CITY HALL. (From Capron Ave., pole 144.)	64	SPECIAL RUN. No other Cars on Road.	June 13, 1894	4.99	3 51 30 A. M.	4 18 9 A. M.	1 18	25 21	11.8	12.6	3200	642	10.15	3	1	4	10	16215
	64	HAULING TRAILER No. 54.	"	"	5 54 32 A. M.	6 30 22 A. M.	6 14	29 36	10.1	11.5	5865	1174	15.95	6	1	7	9	30780
	64	ACCOMMODATION RUN. Car in Regular Service.	Aug. 20, 1894	"	5 51 45 P. M.	6 19 35 P. M.	....	27 50	10.8	13.4	3362	674	9.72	12	1	13	16	......
	64	EXPRESS RUN.	Aug. 21, 1894	"	4 43 0 A. M.	5 1 15 A. M.	0 20	17 55	16.8	18.7	3545	710	15.90	2	0	2	6	15593
	234	EXPRESS RUN.	"	"	2 27 0 P. M.	2 49 0 P. M.	....	22 0	13.7	17.2	3149	630	11.50	9	1	10	10	17280
	31	EXPRESS RUN.	Aug. 20, 1894	"	10 20 15 A. M.	10 46 10 A. M.	0 35	25 20	11.0	12.9	4215	844	13.38	10	1	11	6	22718
ROLAND PARK AND LAKESIDE. (From near Capron Ave., pole 146.)	64	SPECIAL RUN. No other Cars on Road.	June 13, 1894	2.073*	4 46 52 A. M.	4 53 42 A. M.	....	6 50	18.2	17.8	1784	861	21.05	1	0	1	9	16065
	64	HAULING TRAILER No. 54.	"	2.043	5 28 27 A. M.	5 36 20 A. M.	....	7 53	15.6	15.5	3305	1616	33.75	2	0	2	11	31080
	64	ACCOMMODATION RUN. Car in Regular Service.	June 12, 1894	"	3 15 30 P. M.	3 24 5 P. M.	....	8 35	14.3	13.8	1887	924	17.68	1	0	1	11	16365
	64	EXPRESS RUN.	June 19, 1894	"	12 18 21 P. M.	12 24 5 P. M.	....	5 44	21.4	22.9	1750	857	24.58	1	0	1	10	16215
	234	EXPRESS RUN.	Aug. 21, 1894	"	2 3 25 P. M.	2 10 10 P. M.	....	6 45	18.2	21.2	1557	763	18.55	1	0	1	11	17430
	31	EXPRESS RUN.	Aug. 20, 1894	"	11 23 0 A. M.	11 31 0 A. M.	....	8 0	15.3	15.3	2500	1223	25.14	1	0	1	7	22868
Edmondson Ave. Line...	314	EQUIVALENT TO REGULAR SERVICE.	Oct. 8, 1894	6.4	12 5 0 P. M.	12 48 30 P. M.	...	43 30	8.8	10.4	5240	819	9.7	31	2	33	4	16620
Carey Street Line........	234	EQUIVALENT TO REGULAR SERVICE.	Aug. 21, 1894	6.14	10 49 15 A. M.	11 35 20 A. M.	2 10	43 55	8.4	12.5	5350	872	9.8	35	2	37	8	16980
Huntingdon Ave. Line...	314	REGULAR SERVICE.	Oct. 11, 1894	5.31	1 20 0 P. M.	2 3 50 P. M.	....	34 50	9.1	13.0	5850	1102	13.51	26	8	34	26	......
Linden Ave. Line........	314	REGULAR SERVICE.	Oct. 6, 1894	2.615	3 48 0 P. M.	4 12 0 P. M.	....	24 0	6.5	9.7	2307	882	7.74	17	4	21	16	......
Fremont Ave. Line.......	314	EQUIVALENT TO REGULAR SERVICE.	Oct. 8, 1894	2.32	10 30 0 A. M.	10 48 0 A. M.	....	18 0	7.7	8.9	2895	1250	12.95	12	7	19	4	16620
Druid Hill Ave. (Cable) Line.	4	REGULAR SERVICE.	Aug. 23, 1894	4.66	3 44 0 P. M.	4 20 30 P. M.	....	36 30	7.7	8.5	......	....	......	29	6	35	33	......
Linden Ave. (Horse Car).	75	EQUIVALENT TO REGULAR SERVICE.	Dec. 20, 1894	2.615	1 31 0 A. M.	2 0 20 A. M.	0 50	28 30	5.5	6.2	......	....	......	22	0	22	1	5007

CAR WEIGHTS AND EQUIPMENTS:

Car No.	Company.	Kind.	Weights, actual.	Motors.	Contr'l'r.	Truck.
234	Baltimore Traction	Motor	15,800 (avg. wt.)	2-25 hp No. 3 Westinghouse	"G"	Single, "Bemis."
314	" "	"	16,020	" " "	"G"	" "
4	" "	Grip	8,950	....	....	"
75	" "	Horse	4,700	....	....	"
154	" "	Trailer.	5,950	....	....	"
64	Lake Roland	Motor	14,710	2-25 hp "G. E." 800..............	"K"	" "Lord Balto. No. 2."
31	" "	"	21,810	2-25 hp No. 16 Edison...	"K"	Double, "McGuire."
54	" "	" (as trailer.)	14,710	2-25 hp "G. E." 800..............	"K"	Single, "Lord Balto. No. 2."

* From pole 145.

The record of the cable car shows the speeds and lengths of the different cables used on the route. The cable at the Druid Hill Park terminus is a slow one used around the loop. The high-speed cables run through the residence portion of the city and have a speed of 11½ miles per hour, and the slow cables, through the business portion, a speed of 7½ miles per hour. The slight variations in speed are due to the elasticity of the cables, but the larger variations are due to the loosening of the grip in slowing up, as the law requires the car to slow up at every street crossing and to stop at every railway crossing; it can also be seen that the variations due to the elasticity of the cables are much greater at the slack ends than at the tight ends.

AND OTHER CARS RUN UNDER SEVERAL CONDITIONS, ON THE SAME AND ON DIFFERENT ROADS.

RETURNING.															ROUND TRIP.								
	TIME.				Mean speed miles per h.					STOPS.							Mean speed miles per h.						
Distance returning.	Leaving.	Arriving.	Delays.	Net time interval.	Calculated from time interval.	Integrated.	Watt-hours from watt-meter.	Watt hours per car-mile.	Mean E. hp from watt-meter.	Full.	Partial. (3 m. p. h. or less.)	Total.	Passengers.	Total weight, car and load.	Distance.	Net time interval.	Calculated from time interval.	Integrated.	Watt-hours from watt-meter.	Watt-hours per car-mile.	Mean E. H. P. from watt-meter.	Motorman.	REMARKS.
20_o	21_o	22_o	23_o	24_c	25_c	26_c	27_o	28_c	29_c	30_o	31_o	32_o	33_o	34_o	35_c	36_c	37_c	38_c	39_o	40_c	41_c	42	43
	H. M. S.	H. M. S.	M. S.	M. S.												H. M. S.							
6.52	4 28 0	4 46 25	......	18 25	21.2	22.6	3160	489	13.81	1	0	1	10	17313	13.04	41 40	18.8	19.7	10050	772	19.41	McGregor	Track clear, maximum speed.
6.5	10 18 0	10 37 23	0 18	19 5	20.4	23.6	3238	498	13.65	3	0	3	6	22621	13.00	45 36	17.1	19.8	11180	860	19.72	Morton	Following regular car.
"	2 33 0	2 54 0	......	21 0	18.6	20.2	3260	501	12.49	8	1	9	16	......	"	47 50	16.3	17.7	10770	828	18.13	Kelly	
"	4 52 30	5 10 35	......	18 5	21.6	24.8	2615	403	11.63	1	0	1	11	17385	"	43 10	18.1	21.2	9437	726	17.58	Morton	Maximum speed.
"	6 42 0	7 4 20	......	22 20	17.5	17.8	4185	644	15.07	3	0	3	6	15615	12.9	47 40	16.2	16.6	11602	899	19.60	Miller	
"	2 40 45	3 10 50	6 40	23 25	16.6	15.7	4483	691	15.41	1	1	2	13	23760	13.00	53 41	14.5	14.2	15953	1228	23.91	"	
4.99	4 20 33	4 46 18	2 25	23 20	12.8	13.7	8370	1675	28.82	5	0	5	10	16215	9.98	48 41	12.3	13.1	11570	1158	19.12	Miller	Track clear, ordinary speed.
"	6 36 19	7 8 26	4 29	27 38	10.9	12.8	15100	3026	44.00	4	1	5	11	31080	"	57 14	10.5	12.1	20965	2098	29.48	"	Following regular car.
"	6 21 15	6 48 30	......	27 15	11.1	13.6	8815	1774	26.10	17	1	18	24½	......	"	55 5	10.9	13.4	12177	1218	17.78	Marshall	
"	5 4 0	5 23 25	0 10	19 15	15.6	17.2	8363	1676	34.95	3	1	4	6	15593	"	37 10	16.1	17.9	11908	1191	25.80	Miller	Maximum speed.
"	2 51 30	3 18 0	......	26 30	11.4	13.5	7857	1574	23.81	10	1	11	9	17130	"	48 30	12.3	15.3	11006	1102	18.26	Morton	
"	10 47 0	11 16 0	0 20	28 40	10.5	11.1	11520	2310	32.30	9	0	9	6	22718	"	54 0	11.1	11.9	15735	1575	23.47	McClellan	
2.073	4 56 36	5 3 53	......	7 17	17.1	16.9	2850	1375	31.50	1	0	1	9	16065	4.146	14 7	17.6	16.8	4634	1118	26.41	Miller.	Track clear. High speed.
2.043	5 42 16	5 51 23	......	9 7	13.4	13.7	5000	2447	44.10	1	0	1	11	31080	4.086	17 0	14.4	14.6	8305	2065	39.32	"	Following reg. car.
"	3 30 0	3 38 40	......	8 40	14.1	14.1	2432	1190	22.60	1	0	1	11	16365	"	17 15	14.2	13.9	4319	1057	20.14	"	
"	12 36 5	12 42 49	......	6 44	18.2	19.8	2630	1287	31.45	1	0	1	10	16215	"	12 28	19.7	21.4	4380	1071	28.28	"	Maximum speed.
"	2 14 0	2 21 25	......	7 25	16.5	20.1	2468	1209	26.80	1	0	1	11	17430	"	14 10	17.3	20.6	4025	985	22.86	Morton	
"	11 33 0	11 41 50	.....	8 50	13.9	15.6	3625	1773	33.00	1	0	1	7	22868	"	16 50	14.6	15.4	6125	1500	29.28	McClellan	
6.4	12 51 0	1 39 0	.....	48 0	8.0	11.0	8860	1385	14.85	27	7	34	4	16620	12.8	1 31 30	6.3	10.7	14100	1102	9.36	Hoffman	Following reg. car.
6.1	11 41 45	12 19 15	1 30	36 0	10.2	12.0	7785	1276	17.37	18	9	27	8	16980	12.24	1 19 55	9.2	12.3	13135	1073	13.24	Morton.	"
5.28	2 6 0	2 46 15	.....	40 15	7.9	11.6	7610	1443	15.20	30	5	35	33	......	10.59	1 15 5	8.5	12.3	13460	1271	14.42		
2.785	4 12 0	4 35 0	......	23 0	7.3	9.4	5456	1960	19.07	21	2	23	13	.....	5.4	47 0	6.9	9.5	7763	1439	13.29		
2.32	10 52 30	11 10 0	......	17 30	8.0	8.6	3090	1335	14.20	13	10	23	4	16620	4.64	35 30	7.9	8.8	5985	1291	13.56	Cross	Following reg. car.
4.65	4 21 30	4 57 0	......	35 30	7.9	8.8	......	...	......	29	7	36	23	.....	9.31	1 12 0	7.8	8.7	......	....	......		
2.785	2 3 0	2 37 0	3 10	30 50	5.4	6.3	......	....	......	22	0	22	1	5007	5.4	59 20	5.5	6.2	......	....	......	Gorsuch (driver)	Car, horses and driver same as formerly ran. Stops similar.

EXPLANATORY.

o, at the head of a column, means observed values.

c, " " " computed.

Time readings taken within 5 seconds.

Time of ordinary stops not recorded.

Integrated values of speed have a small error due to speed curve being plotted on a distance base, but are truer values than the calculated. The difference is due mainly to time and rate of stopping, etc.

Weights of car and load when in regular service are not given, as load is variable.

Crew not counted as passengers.

Number of stops include one terminal.

Column

9 = Col. 7 — Col. 6 — Col. 8.
10 = Col. 5 × 3600 ÷ Col. 9 (in seconds.)
11 = Integration of speed record.
13 = Col. 12 ÷ Col. 5.
14 = Col. 12 × 3600 ÷ Col. 9 (seconds.) ÷ 746
24 = Col. 22 — Col. 21 — Col. 23.
25 = Col. 20 × 3600 ÷ Col. 24 (seconds.)
26 = Integration of speed record.
28 = Col. 27 ÷ Col 20.
29 = Col. 27 × 3600 ÷ Col. 24 (seconds.) ÷ 746.
35 = Col. 5 + Col. 20.
36 = Col. 9 + Col. 24.

Column

37 = Col. 35 × 3600 ÷ Col. 36 (seconds.)
38 = Integration of speed record.
40 = Col. 39 ÷ Col. 35.
41 = Col. 39 × 3600 ÷ Col. 36 (seconds) ÷ 746

The portions of the records obtained in the suburban, residence and business portions of the city can readily be recognized by the characteristic speeds and number of stops. In the business portion the speed of the car varies from 5 to 10 miles per hour, and makes about 10 to 12 stops per mile ; in the residence portion, from 10 to 15 miles per hour, and about 4 to 6 stops per mile ; and in the outskirts, or suburban portion, from 15 to 30 miles per hour, and about 1 or 2 stops per mile.

In the lower part of Table 10 the various speeds, watt-hours, number of passengers, number of stops, etc., for the trips going and returning and for the round trip are given. The mean speed of the cars for the round trip is obviously much greater with those running into the outskirts than with those confined to the city, and the watt-

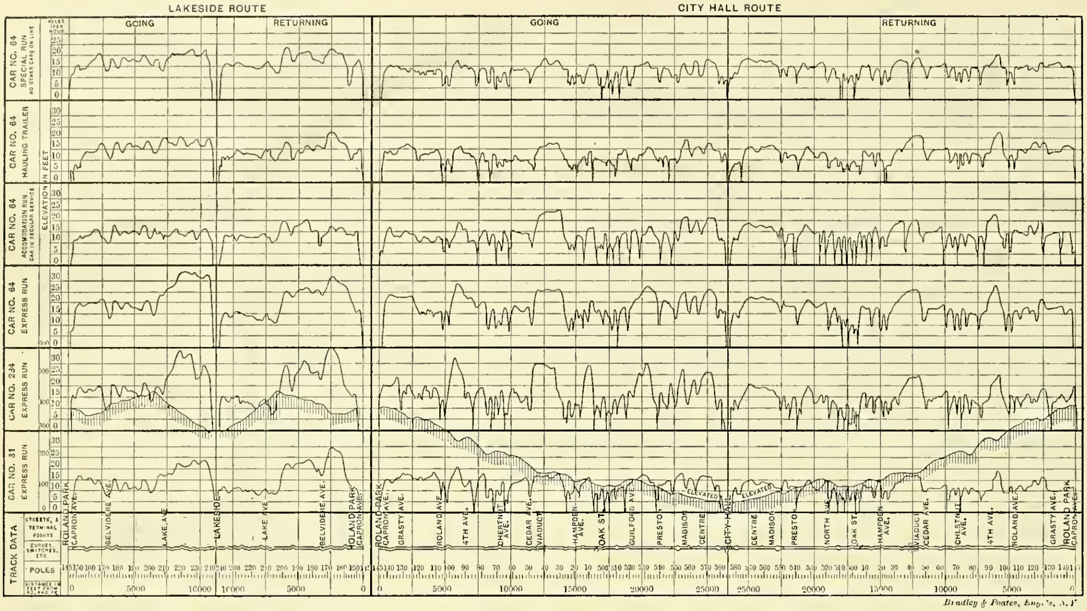


FIG. 30.—COMPARATIVE SPEED RECORDS OF VARIOUS ELECTRIC CARS

RUN ON THE ROLAND PARK ROAD.

CAR EQUIPMENTS GIVEN IN FIG. 29.—DETAILED DATA IN TABLE 10.

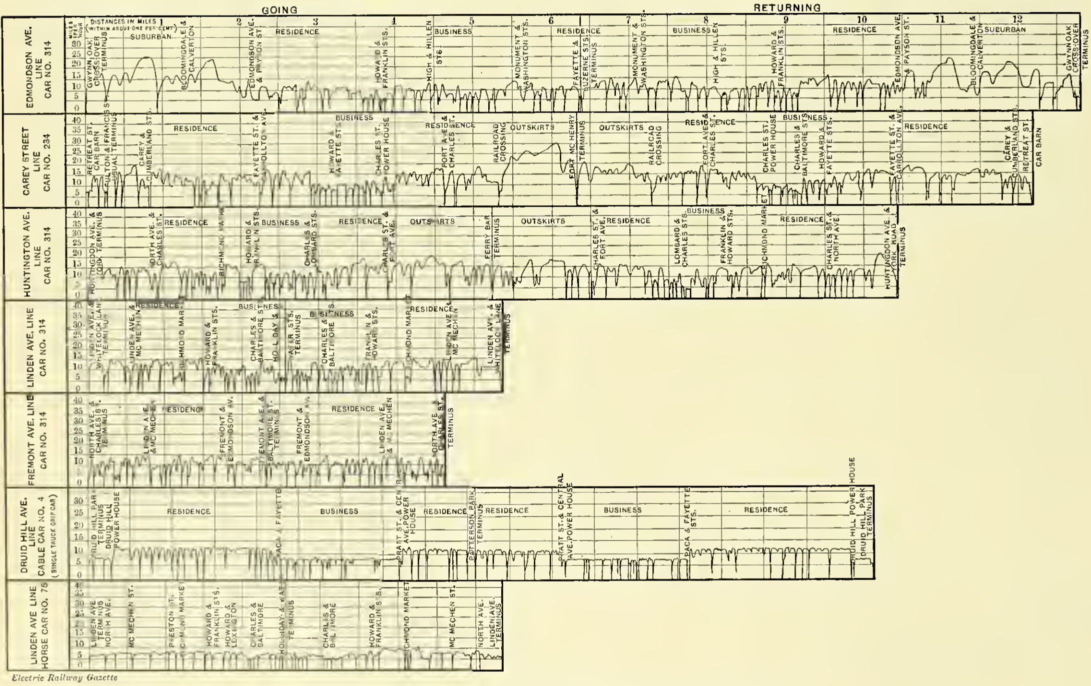


FIG. 31.—SPEED RECORDS OF ELECTRIC AND OTHER CARS.

RUNNING OVER VARIOUS ROUTES, IN REGULAR SERVICE OR ITS EQUIVALENT.

Cars equipped with two 25-hp No. 3 Westinghouse motors and "G" controllers.

DETAILED DATA IN TABLE 10.

hours per car-mile, for the round trip, may vary either with the number of stops, number of passengers, or the character of the road. The roads in Baltimore are all more or less hilly, and there are but few level stretches. A list of the equipments and car weights, as well as some explanatory matter concerning the results, is given at the foot of the table.

(*To be continued.*)

Comments and Views of Contemporaries.

Employees on Electric Cars.—It takes a higher order of intelligence to manage a trolley than it does to drive a mule. We have regular schools of instruction now which the men must attend, and this has brought the best of them forward. Ability is quickly detected by the questions asked and the interest taken, and wherever ability is found it is marked for promotion. The school of instruction is steadily reducing the percentage of accidents, and we expect to get this average below the old average on horse-car lines. Drink has been absolutely prohibited among employees, and the well-remembered mulewhacker, whose capacity for whisky was only exceeded by his versatility in profanity, is of the past. He has been weeded out.—*New York Evening Post.*

Trolley Car Accidents have become relatively infrequent once the people have become familiar with the dangers attendant upon crossing the streets in front of rapidly moving cars, but children are thoughtless and careless, and their lives are consequently endangered by the trolley cars. One of the latest victims was knocked down instead of being picked up by a pick-up fender of the most approved pattern. It was no doubt hooked up too high, as most of them are, but even when set low these fenders are not as sure of saving life as inventors would have us believe. While they might throw a grown person backward into the fender, they are more likely to knock a child down forward and pass over him. They are no doubt better than nothing, but they are very far from being ideal life-savers.—*Philadelphia Public Ledger.*

Electric Locomotives.—Freight yards are now the most promising field for the introduction of the larger sizes of electric locomotives, as the work can be done by them more economically, and with less noise, dirt and smoke. It has been proposed to use storage battery locomotives and to have stalls where tenders loaded with storage batteries may be charged, and the electric locomotive can be run up to the sheds to get a freshly charged tender and deliver an exhausted one in about the same time that is now required to take water and coal. Some such plan was used at the World's Fair with electric launches, a number of them being kept in charging sheds while others were in operation. All these schemes have objections that are at present worrying those electricians who have paid more attention to booming electric locomotives than to devising schemes for using the apparatus after it is made.—*Railroad Gazette.*

Electric Car Held Up.—As the electric transportation system is extended westward, all the difficulties and dangers attending the running of railways in the wilds of uncivilized regions are successively encountered, and experience shows that the new trolley is no more exempt from the accidents and incidents familiar in the remote regions of the country towards sunset than the old steam cars. Recently, in one of the outlying wards of Chicago, somewhere this side of the Great Bend of the Missouri, an electric car was held up by highwaymen in the regulation wild-western fashion, and the passengers induced by the means commonly resorted to in such cases to hand over their wallets, watches, loose change, whatever other valuables they had, without distinction of age, sex, or previous condition. One of the unfortunates, venturing some untimely objection, was promptly shot as a warning to the others, and then, after cutting the wires, the robbers rode away into the unknown recesses of the wilderness, leaving the despoiled party out in the middle of nowhere, to get back to the inhabited parts of the country as best they could. Chicago is ambitious and naturally anxious to bring her far-western territories into communication with the known world, but there evidently is a point beyond which it is not safe to penetrate into the unexplored regions of her annexed districts.—*Philadelphia Telegraph.*

Electric Motors for Tunnels.—The avidity with which the managers of the trunk railways are taking to the introduction of electric propulsion at certain points on their lines is remarkable in view of the opposition to this power recently exhibited by representatives of these same railways. The application of electric power to the Nantasket Beach line on the New York, New Haven & Hartford's Old Colony division, the introduction of electric engines in the Baltimore tunnel of the Baltimore & Ohio road, and the declaration of other roads of their intention to use electric propulsion for yard and switching service, is followed by the announcement that the Grank Trunk Railway is making preparations to use electric engines in its tunnel under the Detroit River at Port Huron. While the desire to avoid smoke and cinders was given out as the reason for the adoption of electricity for the Baltimore tunnel, it is significant and suggestive that the Grand Trunk is led to comtemplate electric propulsion in its famous tunnel on account of the deleterious effects of steam upon the structure of the tunnel itself. The tunnel, which is cut through the rock, is lined with steel casing, back of which is a filling of what is said to be a peculiar kind of asphalt. The tunnel is a mile and one-eight in length, and the grade at both ends is an important one, amounting to 105 feet in the mile. Specially constructed locomotives, weighing 95 tons, and having eight drivers, are used to haul trains through. In developing the energy needed to handle long, heavy trains it has been found, it is stated, that the excessive heat and escaping steam from the engines are exercising an effect upon the asphalt backing, the result of which is its deterioration. In other ways, it is stated, steam has been found to exercise influences upon the tunnel structure that are serious. It can readily be seen that the use of electric propulsion in railway tunnels will have marked advantages over steam power in many ways, but we look upon this departure as more important regarded in the light of an entering wedge, than as a mere victory of one kind of power over another for tunnels. When the electric engine has become thoroughly established in favor with the managers of railroads, it will be but a step from its use in tunnels to its introduction in railroad yards, and the extension of its use to all kinds of suburban service and finally to entire divisions. Moreover, judging from the progress already made, this extension will undoubtedly be more rapid than most people at the present time have any good reason to suppose.—*Burlington, Vt., Press.*

Right to Carry Freight Questioned.

The village of Cortland, N. Y., proposes to institute a suit to determine whether the Cortland & Homer Traction Company has the right to introduce a freight service. The village trustees object to the operation of freight cars on the streets, and assert that an injunction will be applied for to prevent their introduction. The company expects to carry freight from the Deleware & Lackawanna tracks to points which its line reaches.

FINANCIAL NOTES.

PETERSBURG, VA.—Judge J. M. Mullen, of the Corporation Court, has ordered the sale of the Petersburg Street Railway and the Petersburg & Asylum Railway, at noon, on Wednesday, Jan. 22, 1896. There are liens on these two roads estimated to amount to about $130,000.

REPORTED SALE OF STEINWAY RAILWAY.—It has been reported that the Steinway Railway, of Long Island City, N. Y., has been purchased by Philadelphia capitalists, who have secured control by obtaining the stock of Cord Meyer and the New York owners of the property.

MARKET STREET BOND ISSUE VALID.—The Supreme Court has affirmed the validity of the $17,500,000 bond issue of the Market Street Railway Company, of Los Angeles, Cal. In October, 1893, 11 street railway corporations, owning nearly every street car line in the city, were consolidated as the Market Street Railway Company. To refund indebtedness and get money for construction purposes, the directors made a blanket mortgage on all the property of the combine for $17,500,000. The manner in which the bonds were issued was attacked, but this decision sustains the action of the company.

NORTH SHORE TRACTION.—Attention has been called to the fact that West End preferred stock, paying 4 per cent. per annum, sells around 90, while North Shore Traction preferred, paying 6 per cent., commands no higher price. The latter is listed in Boston, though practically owned in New York. The point is made that the country along the North Shore is increasing in population, and Boston is talking to the effect that North Shore Traction will be a second West End. The company has no floating debt, and has some $225,000 worth of actual cash assets. It pays dividends on its $2,000,000 preferred stock, and expects in a comparatively short time to be able to pay on the $4,000,000 common.

NEW INCORPORATIONS.

PITTSBURG, PA.—The Ohio Valley Electric Railway Company has been formed by William T. Lindsay and Henry E. Lineaweaver, Pittsburg, and Edgar C. Gerwig, Allegheny, to build a railway in Allegheny County. Capital stock $25,000.

CHICAGO, ILL.—The Evanston Electric Railway Company has been organized by Andrew Crawford, Thomas C. Milsted and Parke E. Simmons, to acquire, maintain and operate horse, dummy and electric street railways. Capital stock $200,000.

BARRIE, ONT.—The Barrie & Allendale Electric Street Railway Company has received its letters of incorporation from the government and will construct and operate an electric railway in this place and one mile and a half beyond. The promoters are J. H. McKeggie, J. Vair, G. Reedy, S. J. Sanford and J. Dickinson.

ST. MARY'S, O.—The Lima and Piqua Electric Street Railway Company has been formed with a capital stock of $9,000 to build and operate a street railway between Piqua and Lima, to be operated by steam, electricity or other motive power; also to furnish light, heat and power. The promoters are L. C. Faurot, D. W. Jay, D. Armstrong, William H. Hartman, S. W. McFarland and Edward Burns.

NEWS OF THE WEEK.

READING, PA.—An electric railway is contemplated between Allentown and this place.

SCHUYLERVILLE, N. Y.—Either an electric or steam road to Greenwich is contemplated.

MILWAUKEE, WIS.—The Milwaukee Street Railway Company is thinking of building to Racine via Cudahy.

SEBEC, ME.—Sebec citizens are beginning to agitate the building of an electric railway from their town to Dover.

DETROIT, MICH.—The Citizens' Street Railway Company will probably double-track all of its Trumble Avenue line.

WEST FAIRVEW, PA.—The question of an electric road from West Fairview, connecting Marysville with Harrisburg, is talked of.

MEADVILLE, PA.—The Common Council has passed the electric street railway bill, and the company will soon commence to build.

UTICA, N. Y.—A franchise has been granted by the City Council to the Belt Line Railway Company for the establishment of its tracks, etc.

NIAGARA FALLS, N. Y.—It is reported that efforts are being made by still another street railway company to obtain a franchise in this city.

WINDSOR, ONT.—A syndicate represented by Edmund Bristol is asking for a charter for an electric railway between this place and Montreal.

LITTLE FALLS, N. Y.—The Little Falls Street Railway Company has applied to the City Council for permission to lay its tracks through the city.

WEEDSPORT, N. Y.—The construction of a belt line electric railway, connecting Auburn, Port Byron, Weedsport, Jordan and Skaneateles, is in contemplation.

ALBANY, N. Y.—The Railway Commissioners have approved of the use of electricity as a motive power on the New York, Elmsford & White Plains Street Railway.

SIOUX CITY, IA.—The Sioux City Bridge Company has obtained the right of way above and across a part of First Street for the purpose of laying railway tracks.

MILLBURY, MASS.—The town authorities have acceded to the request of the Blackstone Valley Street Railway Company for right of way through certain streets.

UNION CENTRE, N. Y.—The projectors of the Union & Lestershire road also contemplate the establishment of an electric railway from Union to Maine, passing through this place.

MOBILE, ALA.—At a meeting of City Council, the report of the committee on the petition of the Mobile Street Railway Company to extend its Dauphin Street tracks, was adopted.

BRISTOL, PA.—The Holmesburg & Bristol Trolley Company is meeting with success in its efforts to obtain the right of way from Torresdale to Bristol necessary to complete its line.

BOSTON, MASS.—The West End Street Railway Company has petitioned the Board of Aldermen for leave to construct and use a double track on Columbus Avenue and other streets.

LOS ANGELES, CAL.—The Los Angeles & Pasadena Electric Railway Company has applied to the board of supervisors for a franchise to extend its line from Pasadena to Altadena.

DETROIT, MICH.—The Detroit & St. Clair River Electric Railway Company has filed a mortgage for $358,000 with the city clerk of Marine City, and there is no doubt the road will be built.

WATKINS, N. Y.—The projected Watkins and Havana Railway will probably be extended from Havana to Horseheads, so as to make connection with the Elmira & Horseheads Railway.

MONTCLAIR, N. J.—The trolley franchise question was decided upon by the Montclair Town Council at a meeting held Oct. 21. The application of the North Jersey Traction Company was rejected.

SAGINAW, MICH.—A 30-year franchise has been granted to the Saginaw Street Railway Company for the construction and operation of an electric line along the Genesee Plank Road to Bridgeport.

SHAMOKIN, PA.—Work will be commenced at once on the new trolley line between Sunbury and Selin's Grove, a distance of 10 miles. Major J. H. Hamilton, of Shamokin, is one of the projectors.

AVALON, PA.—The Ohio Valley Electric Railway Company has received its charter. The line will run from Avalon, Allegheny County, to Clenfield Borough. W. B. Carson, of Pittsburg, is president.

ASBURY PARK, N. J.—The Asbury Park, Bradley Beach, Delmar & Spring Lake Railway Company, proposed to build southward from Asbury Park, and it is said the road is eventually to be extended to Atlantic City.

WAVERLY, IOWA.—A company is to be organized for the purpose of building an electric road from this place to Cedar Falls. J. H. Bowman, president of the First National Bank, is interested in the project.

ISLIP, L. I.—A franchise for the construction of a trolley line from Oakdale to this place has been granted by the Town Board to ex-Justice George B. Studley and Alexander B. Martin, representing a syndicate of New York capitalists.

HAMBURG, N. Y.—The Hamburg Railway Company has filed with the Secretary of State a certificate of an extension of its route along the Ridge Road, 1,000 feet from White's Corners Road, westerly, thence over private property to Blaisdell.

OWOSSO, MICH.—The City Council has granted a 30-year franchise to the Owosso & Corunna Traction Company. The road will be extended over several streets in Owosso and new cars and electrical equipment used. Work will be begun at once.

CLEVELAND, O.—The Cuyahoga Suburban Railway Company is ready to accept the franchise for its South End Road, which was recommended by the Board of Control to the City Council, and will proceed promptly upon receipt of the papers.

GRAND RAPIDS, MICH.—The citizens of Oakdale Park and vicinity have prepared a petition with 435 names attached, and presented it to the Consolidated Street Railway Company, asking that the company extend its Madison Avenue line to Oakdale Park.

ST. GEORGE, S. I., N. Y.—At the regular meeting of the Edgewater trustees, the Staten Island Electric Railway Company put in an application for right of way upon several streets in the village. The application will be argued before the Board Oct. 29.

JEFFERSONVILLE, IND.—A syndicate represented by C. H. Williams has bought the Jeffersonville Street Railway plant and will equip it electrically and make considerable extensions. It is said that twenty-five miles of additional track will be put down.

CLEVELAND, O.—The South Brooklyn Village Council has passed an ordinance authorizing the Big Consolidated Street Railway Company to construct and operate an extension of its railway through Pearl Street to the corporate limits of the village of South Brooklyn.

DENVER, COLO.—The owners of the property in Clear Creek Valley met recently to promote the building of the Denver, Globeville and Golden Rapid Transit Electric Line. E. C. Randell, Eighteenth and Lawrence Streets, is general manager and purchasing agent.

ST. CATHARINE'S, ONT.—The Lincoln Street Railway, Traction & Light Company has presented a petition to the government for letters patent, which the City Council of this place has endorsed. William Wilson, George Palmer, R. H. Hill and H. A. King are interested.

PHILADELPHIA, PA.—The Philadelphia Traction Company has been granted permission by the Board of Highway Supervisors to lay curves connecting its Market Street tracks with those in Twelfth, Thirteenth, Fifteenth, Sixteenth, Nineteenth and Twenty-second Streets.

NESHAMINY, PA.—Papers are being circulated among property owners along the Bristol turnpike for the purpose of securing their consent for the construction of a trolley road from the city line at Poquessing Creek north to Neshaminy Creek, a distance of about three miles.

TONAWANDA, N. Y.—It is understood that capitalists are to resume operations and complete an electric road from North Tonawanda to Sanborn and Pekin. Louis Payne, attorney, has announced that he has succeeded in interesting several influential capitalists in the undertaking.

EDGEWATER, S. I., N. Y.—The Staten Island Electric Railway Company has begun to lay tracks on the Clove Road, despite the fact that the Midland Company has claimed possession of it. The first-named company has also begun to lay tracks upon Columbia Street, West New Brighton.

CORTLANDT, N. Y.—At a meeting of the Highway Commissioners, Attorney John Gibney, of Sing Sing, presented the application of the Croton Valley Electric Railway Company for a franchise to operate a trolley railway line between Croton-on-Hudson and the new Cornell dam.

JEFFERSONVILLE, IND.—Representative Williams for a Southern syndicate, has purchased the Ohio Falls Street-Car Company, of this city, and will at once equip the line with electricity. To connect with the Big Four bridge at Louisville, 25 miles of additional track will be laid.

MILWAUKEE, WIS.—Manager Wyman recently announced that negotiations were pending, whereby the Milwaukee Street Railway Company, and the Racine Street Railway Company, expect to reach an agreement, so that the Cudahy branch of the local line can be extended to Racine.

OTTAWA, ONT.—Application is being made for the incorporation of the Canada Electric Railway & Power Company to build an electric railway from Montreal to Windsor, Ont., via Brockville, Kingston, Belleville, Toronto and London, with power to build branch lines to Suspension Bridge and elsewhere.

SOUTH FRAMINGHAM, MASS.—The petition of the Milford, Holliston & Framingham Electric Railway Company for a franchise has been granted by the Framingham Board of Selectmen, and a line will be constructed from the Ashland boundary line to connect with the tracks of the South Middlesex electric road.

DAMASCUS, MD.—A meeting of citizens of Frederick, Montgomery and Howard counties, was held in Damascus, Montgomery County, Oct. 17, in the interest of the electric railway contemplated between Washington, D. C., Sandy Springs, Baltimore, Ellicott and Frederick cities. The project is universally approved.

TUNKHANNOCK, PA.—An electric railway is contemplated between this place and Carbondale, Pa., to be known as the Tunkhannock & Carbondale Street Railway. George M. Shepherd is the principal party in the movement. It is reported also that an electric road will be built between this place and Scranton at an early date.

DEERING, ME.—The Portland Railway Company has requested permission to locate tracks, with the turnouts, appliances, etc., and erect poles, wires and necessary electrical appliances for the operation of its cars, from the point where its present tracks terminate at Morroll's Corner, to the Penobscot river and Pride's Bridge.

CHICAGO, ILL.—The petition of the General Electric Street Railway Company for the drainage board's signature to the application of the company for a franchise on Kedzie Avenue, from Twenty-second to Thirty-first Street, was refused, on the ground that the sanitary district, being a municipal corporation, could not join in a petition to the City Council for the use of the streets.

PITTSBURG, PA.—The first section of the Pittsburg, Jeanette & Greensburg Electric Railway, extending from Greensburg to Jeanette and Manor, will be finished about Nov. 4, and it is expected that cars will be in service by Nov. 10. The company has purchased the plant and rolling stock of the Greensburg & Hempfield Electric Railway, which will be overhauled throughout.

CHICAGO, ILL.—The Suburban Electric Railway Company has filed a petition in the Circuit Court to condemn the right of way through the northern portion of the village of Riverside. The land proposed to be taken is a 30-foot strip extending for about a mile to the Desplaines River. The property has never been platted or subdivided, and consequently can be taken at the hands of a jury.

THE PECKHAM MOTOR TRUCK AND WHEEL COMPANY has received a letter from Mr. Wm. H. Shelmerdine, president of the People's Passenger Railway Company, of Philadelphia, speaking in the highest terms of Peckham trucks, and stating that they cost comparatively nothing for repairs. As a practical indorsement of their good opinion of Peckham trucks the People's Passenger Railway Company states that second and third orders—amounting to 490—were placed for them.

BENNINGTON, VT.—Superintendent E. D. Bennett, of the Bennington & Rutland Railway, is consulting with electrical engineers as to the feasibility of substituting electricity for steam on the branch line between here and North Bennington. The success attending the introduction of electricity for short runs on the Baltimore and Ohio, and New York & New England railways, has caused the officers of the Bennington & Rutland to call for estimates, etc., as to what can be done on this line of their road.

BOSTON, MASS.—A committee representing the Dublin (Ireland) Tramway Company, which proposes to build an electric railway in Dublin, visited Boston this week, and paid a pleasant visit to General Manager Sergeant, of the West End Street Railway Company, and Mayor Curtis. The gentlemen comprising the committee are Dr. Carte and Messrs. Anderson, Wigham and Murphy. The committee proposes to make a tour of the United States for the purpose of obtaining all the information possible concerning the status of trolley and conduit railway systems in this country.

BALTIMORE, MD.—The City and Suburban Railway Company, last week began running an electric car on its Frederick road branch as far as Loudon Park. Within two weeks the operation of the entire line to the Catonsville terminus will be started. From Loudon Park, passengers are transferred to a bus line going to Catonsville. Only the north track of the road is being utilized, owing to the incompleted state of the steel bridge over Gwynn's Falls. This bridge is to be finished this week, and additional cars will then be put in service. The operation of the line by electricity displaces the last horse-car line in Baltimore.——The Baltimore & Gunpowder Railway Company has asked for right of way, for a road to run from the intersection of Monument Street and the boundary line to the Philadelphia road, and along that to Gunpowder River. The road is intended to be a feeder to the Sparrow's Point line. James Young, James Gilmore, Charles B. McClean, William Schluderberg, Frederick J. Schneider and Wm. A. Smith, are interested.

TRADE NOTES.

THE FOREST CITY ELECTRIC COMPANY, of Cleveland, O., is sending out from its New York office, 126 Liberty Street, a very conveniently arranged catalogue of "Roll drop" commutator segments. The book contains full-size illustrations of all the commutator bars now in use by manufacturers of standard railway motors, and under each cut are specifications of the exact thickness of the outer edge of the bar, number of divisions in the complete commutator, and the weight of a full set of segments. This feature will commend itself at once to purchasers of commutators bars, who can see at a glance just what style of bar they require and what the complete set will weigh.

THE WATER CIRCULATING GRATE COMPANY, of 1026 Filbert Street, Philadelphia, has issued an illustrated catalogue which describes at great length the Reagan grate manufactured by the company. This grate is composed of heavy two-inch iron pipes running lengthwise under the boiler, between which are "choppers," the function of which is to break up the fire in somewhat the same manner that an ordinary shaking grate does. The feed water for the boiler is circulated through these pipes, the claim being that much of the heat which would otherwise be lost up the stack is utilized by the water grate. The pamphlet contains also much other information of a very useful nature to steam engineers.

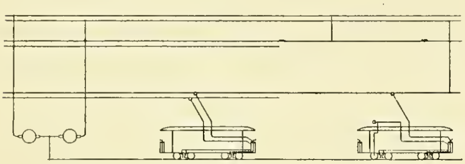
Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED OCT. 22.

548,173. LIFE GUARD FOR STREET CARS; William Black, New York, N. Y., assignor of eleven twentieths to Edward Hassett, same place, and John F. Couch, Brooklyn, N. Y. Filed April 14, 1894. The car is provided with a truck frame which has supporting trunnions and brackets in combination with a car fender having a frame and net, the former having fixed rods and shaft. The rods are actuated by springs.

548,219. CAR BRAKE; Cornelius B. Oviatt, North Yakima, Wash. Filed Jan. 9, 1895. A transverse beam is provided with depending arms, the brake shoes being arranged adjacent to the wheels and slidingly mounted on the car. Circular eccentrics encircle the beam and are fulcrumed on the arms. Curved connecting bars extend from the eccentrics to the brake shoes and a rock shaft is provided with opposite arms. Longitudinal connecting bars extend from the arms of the eccentrics, and means are provided for operating the rock shaft.

548,286. CAR FENDER; John Balmore, New York, N. Y., assignor of one-half to Edward E. Gold, same place. Filed Aug. 28, 1893. A cushion is fixedly mounted on the front platform and a fender consisting of a frame with transverse cushions is pivotally connected to the car so that it may be turned up when out of use. The fender may be raised or lowered and a catch is provided for holding the fender in an elevated position, and when this is released the fender falls upon the track.



NO. 548,388.—REGULATING ELECTRIC MOTORS

548,300. CAR FENDER; Lawrence Dulligan, Rochester, N. Y. Filed July 31, 1895. The fender frame is movable upon ways, and pulleys are connected to the frame and serve by their rotation to project it. Movable supports are provided for the pulleys, and devices are employed for bringing the pulleys in contact with the car wheels. A catch holds the pulleys in contact in such a way that they may be released by the movement of the frame.

548,331. MAGNETIC BRAKE; Oakley S. Walker, Worcester, Mass. Filed Feb. 20, 1895. A shell is provided with a bearing surface adapted to bear against a rotating wheel and enclosing a chamber opening upon the bearing surface of the shell. Holes communicate with the chamber and a core is enclosed concentrically in the latter and integral with the shell. An electric coil is held in the chamber and surrounds the core with its ends passing through the holes in the shell. A block of wood which is held in the chamber covers the coil with its outer surface flush with the chamber surface of the shell.

548,335. AIR BRAKE; Edward J. Wessels, Westfield, and George S. Lee, Hawthorne, N. J., assignor to the Standard Air Brake Company, New York, N. Y. Filed March 8, 1895. This is the combination of an air reservoir, valve and valve casing, brake cylinder, air pump, exhaust cylinder connected to the valve casing and to the air pump cylinder, and means for admitting atmospheric air and for straining the same.

548,339. FENDER FOR STREET RAILWAY CARS; Henry Wilson, Philadelphia, Pa. Filed July 11, 1895. The fender has radial and tilting suspension, and a framework is provided therefor of curved, inclined and hollowed bottom construction. A connecting network is attached to the frame on the front of which is a flat, flexible projecting flap. Springs are arranged underneath for its support and at its back springs maintain the structure in normal position when not in operation.

548,371. ELECTRIC LOCOMOTIVE; Walter H. Knight, New York, N. Y. Filed June 15, 1888. This is the combination of the axles of a railway truck and framing mounted thereon with an electric motor having at its yoke-end a bearing upon the axle independent of the framing. There is a connection between the motor and framing, whereby the free end of the motor is upheld, the car body having a spring support independent of the frame.

548,388. REGULATING ELECTRIC MOTORS; William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed July 22, 1895. The patent relates to the art of operating electric motors upon a three-wire or series-multiple system and consists in dividing the motors upon each car into two groups, one group upon each side of the system and simultaneously operating the two groups by the series-parallel method of control. (See Illustration.)

548,389. THREE-WIRE ELECTRIC RAILWAY; William B. Potter, Schenectady, N. Y., assignor to the General Electric Company of New York. Filed Aug. 8, 1895. The three-wire system comprises a divided source of electromotive force, a track or ground return forming a negative at zero potential, the neutral conductor at 500 volts positive potential, and a positive conductor at 1,000 volts positive potential.

548,434. FARE REGISTER; Leo Ehrlich, Gustavus Rein and Ephron Catlin, St. Louis, assignors to the St. Louis Register Company, same place. Filed Oct. 12, 1892. A disengaging device releases the trip register so that it may move backward to zero, and a motor spring automatically returns the trip register to zero after having power stored up in it by step by step actuation. Toothed gearing connects the spring with the trip register.

548,448. CONTROLLER FOR ELECTRIC MOTORS; Daniel J. McLane and George W. McClintock, Quincy, Mass. Filed May 25, 1895. A truck is arranged as a feed wire terminal and a series of spring pressed contact members is provided. A pivoted lever has a segment at one end arranged to engage the truck and a roller, carried by the opposite end of the lever, is arranged to engage with the contact members.

548,481. UNDERGROUND CONDUIT FOR ELECTRIC RAILWAYS; Richard Uren, Hancock, Mich. Filed May 10, 1894. This is an open insulated conduit for electric railways partly filled with water or other conducting fluid, and having a stratum of oil or other non-conducting fluid of less specific gravity superimposed thereon. A conductor is located in the conduit and a trap is provided having a discharge pipe with a strainer connected to it leading to the conduit.

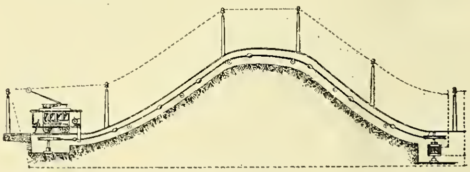
548,504. COMBINED ELECTRIC AND CABLE RAILWAY; Gardner E. Beach and Morris J. Kern, San Francisco, Cal. Filed Aug. 1, 1892. This electric railway has a short cable system, and a haulage cable is adapted to serve as an auxiliary power for the propulsion of cars. The cable road is actuated by an electric motor, driven by electricity derived from the same source as supplies the car motor. (See Illustration.)

548,509. ELECTROMAGNETIC BRAKE; John L. Black, St. Louis Mo., assignor to the St. Louis Electric Brake Company, East St. Louis, Ill. Filed May 9, 1894. This is the combination in an electromagnetic brake, of a brake mechanism and an electromagnet, having an unobstructed central opening and two separate cores arranged therein and connected to the brake mechanism. When the current is applied, the cores approach each other by moving in opposite directions to a point of equalization.

548,510. ELECTROMAGNETIC BRAKE; John L. Black, St. Louis, Mo., assignor to the St. Louis Electric Brake Company, East St. Louis, Ill. Filed March 9, 1894. The magnet has an unobstructed central opening, and cores formed in sections are movably secured together, connections being made between the outer sections of the cores and the brake mechanism.

548,514. UNDERGROUND CONDUIT SYSTEM; Hiram C. Burk, Cleveland, O. Filed Feb. 28, 1893. A line wire is inclosed in insulating material in the conduit wall, and a strip or series of strips is hinged to the wall, but insulated therefrom and located under the conduit slot. Bell crank levers are pivoted in the insulating material and are provided with long arms located under the line wire and short arms adapted to support the strip or strips with insulating blocks between the line wire and the longer arms.

548,570. STREET CAR FENDER; Henry Meyer, Alton, Ill. Filed May 27, 1895. This is the combination with the frame, rotatable shaft and means for actuating the same, of an apron and brackets secured to the dashboard, slotted rod connected therewith, a ring working in the slots and secured to the apron, and the coiled spring.



NO. 548,504.—COMBINED ELECTRIC AND CABLE RAILWAY.

548,581. SAFETY AND EMERGENCY BRAKE; Felix McDermott, Worcester, Mass. Filed May 13, 1895. The brake comprises levers extending transversely and mounted so as to swing and to slide. A cam is held on the staff which is under the control of the operator and is adapted to engage the pivot ends of the levers so as to force the latter outward. An S-shaped cam engages the levers and holds them in an uppermost position.

548,599. ELECTRIC STREET CAR CONTROLLER; Gustaf Valley, Cleveland, O., assignor to the Steel Motor Company, same place. Filed Dec. 5, 1894. A disc is attached to the drum of the controller and has notches corresponding to the operative positions of the drum. One of the notches corresponds to the cut-off position of the drum. A disc is attached to the switch shaft and has notches corresponding to the forward and reverse positions of the switch. A pivoted pawl is adapted to engage at one end the notches of the disc on the drum, having its other end adapted to engage the notches of the disc on the switch shaft. A spring is provided for normally maintaining the pawl in contact with the disc on the drum.

Electric Railway Gazette.

Vol. XIII. NEW YORK, NOVEMBER 9, 1895. No. 19.

Conduit Railway System of the Metropolitan Company of Washington—II.

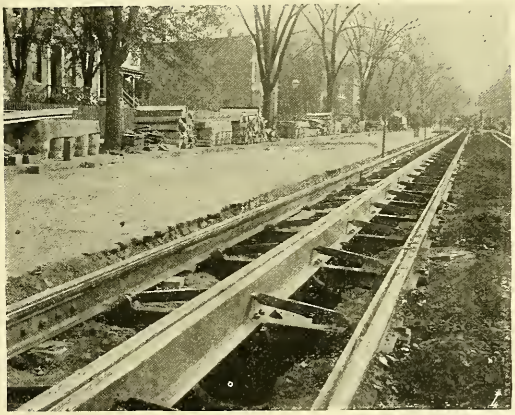
The most interesting feature of the new system of the company is the conduit construction. No pains were spared in making the plans, the utmost care was devoted to details, and no question of cost was allowed to interfere with the success of the undertaking when the work was executed. The conduit is constructed of concrete tubes. The yokes, which weigh 286 pounds each, are spaced 4½ feet apart. The conduit is crowned at the top, with 67-pound slot rails, which are provided with flanges for preventing the drip from running down the sides of the conduit and reaching the insulators.

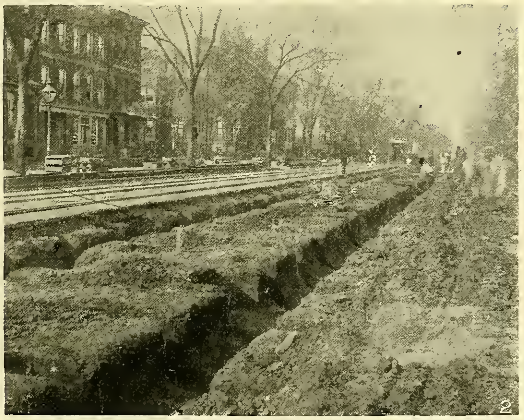
The general method of construction is shown in Fig. 1, in which the ironwork is ready for the concrete. The conductors are stoutly supported. The details of the heavy porcelain insulators are shown in Fig. 4. The insulators are cylindrical, and their dimensions are 7½ inches by 4½ inches. Powerful clamps support the T-bar conductors shown in Fig. 4, which weigh 22 pounds to the yard. Two of the T-bars are located in the conduit, with their flat sides facing each other, and between them travels the contact shoe or plow. As the bars are sufficiently stout to be stiff, and as the points of support are frequent, the structure is extremely rigid, and to this fact Mr. Connett, the chief engineer, attributes a large measure of the success of the installation.

At every yoke a handhole is located, and manholes are built at convenient intervals, so that the conduit system is readily accessible at all points. The conduit is effectively drained as shown in the sketch, Fig. 6. Every 300 or 400 feet a trench is dug 20 inches wide and 6 feet deep, extending across the track. At one end is a pit 9 feet deep, and on the 6-foot level piping drains the trench into the sewer. The pit serves as a catch basin to arrest the refuse that enters. The conduits slope toward the trenches. The manholes are so built that the catch basins may be readily cleaned, and at these points access to the ducts in which the feed wires are carried may be gained.

The insulation of the underground system is entirely satisfactory. Only one half an ampere is lost on the positive main and counts as an actual leakage. On the negative wire four amperes are missing, but as they find their way back to the station by some route other than that provided the loss cannot be regarded as leakage. Mr. Connett states that the leakage costs the company only .7 cent per day. The fact is interesting, and incidentally it goes to show how successful has been the plan to guard against loss in all parts of the installation.

The plan followed in the track construction is worthy of note. After the ground





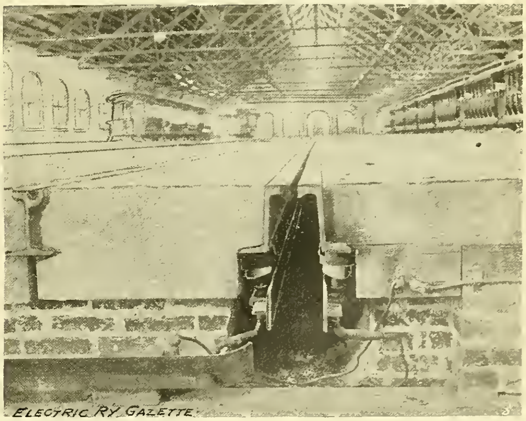


FIG. 1.—IRON CONSTRUCTION READY FOR CONCRETE—FIG. 2.—EXCAVATION FOR CONDUIT—FIG. 3.—END OF CONDUIT IN CAR HOUSE SHOWING SPECIAL INSULATORS.

has been cleared the excavation is so made that the yokes fit quite accurately in position. The yokes are first put in place, and to them the slot rails are bolted. No ties are used. The rails are wedged by steel wedges in notches in the yokes provided for the purpose. After the entire construction has then been straightened wooden formers are placed inside the yoke and are fastened in position. A mixture of cement and rubble is packed firmly around them and the yokes. A great deal of labor and money has been expended in the conduit construction, but as the result is a structure of a solid and permanent character, the outlay was abundantly justified.

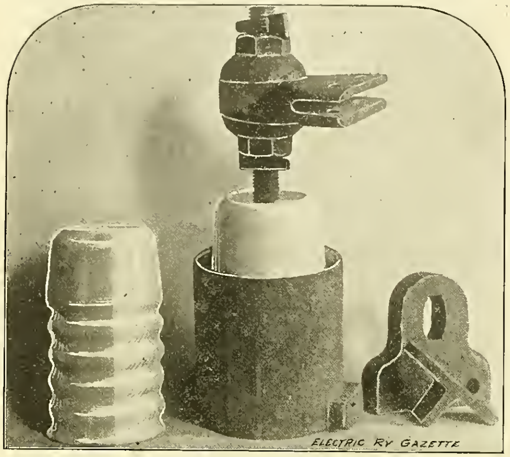


FIG. 4.—STANDARD INSULATOR, CLAMP AND SECTION OF T-BAR.

The conductors and insulators are put in position in the formed conduit, through the handholes and manholes. The yokes form a powerful tie, which prevents the loosening of the construction, however much the car may pound. The rails which have been laid weigh 83 pounds per yard. Over this construction the motor cars and trailers can readily attain a speed, when desired, of 20 miles per hour.

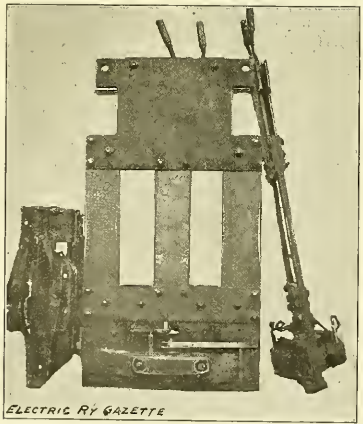


FIG. 5.—THREE VIEWS OF CONTACT PLOW.

The contact plow is an ingenious device and the company was fortunate in securing at the very outset a successful shoe for this purpose. The form now in use has been but slightly altered from that which was originally used. Three views of the plow are presented in Fig. 5. As will be seen from the illustrations, the motion of the shoe is confined to a horizontal plane by a lever. A flat spring affords the necessary pressure and a positive contact is insured by means of a separate flexible wire secured to each shoe. The plow is suspended from the truck frame and has but one inch play from the positive position of the axles. In practice the mechanism is provided with a flexible rubber sheathing. A fuse is provided on every plow arranged to blow in case of a short circuit. The operation of the device has proved successful in a way that has been extremely gratifying to Mr. Connett.

The cars are equipped with G. E.-800 motors and K controllers.

In reference to the matter of short circuits, Mr. Connett recently said in response to a query of the writer that when the system was first opened trouble from this source was experienced; metal barrel hoops and other material found its way into the slot, accidentally or otherwise. Of late, however, trouble due to this cause has entirely ceased. The dynamos are built up under load, and therefore effectually burn out any short circuits that occur when the line is not in use. As an excellent measure of precaution the circuit-breaker is shunted with a water resistance and by this means the circuit-breaker, dynamo and engine are saved from serious damage.

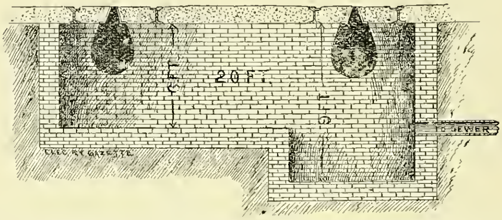


FIG. 6.—SECTION OF ROADBED AT MANHOLE SHOWING METHOD OF DRAINING.

In conclusion it may be said that the company find that the new system presents many advantages. No trouble is experienced from the jumping trolley; as the circuit is entirely metallic there are no electrolytic effects to contend with. The telephone company makes no complaint either on the ground of electrolytic or inductive effects, and the receipts of the road compare very favorably with the operating expenses.

Street Railway Mail Service.

In his annual report to the Postmaster-General, Second Assistant Postmaster-General Neilson writes: "Experiments in trolley mail service were tried first in St. Louis, next in Brooklyn, Boston, Philadelphia and New York. We have established the fact that it is consistent, economical, and almost necessary to establish exactly the same three branches of the service under the improved methods of street-car service that are already successfully established on steam roads."

Concerning the Trenton Decision.

BY FRANK BOURNE.

We noticed in The Gazette of Oct. 19, 1895, a long account of the suit brought by Samuel S. Bennett and Charles S. Cooper against the Trenton Passenger Railway Company. The account of the suit, as given in your paper, while apparently intended to report the proceedings of the case, is merely a report of the evidence of Mr. Elmer and Mr. Woodbridge, experts for the plaintiffs. It does not in any manner give the railway company's side of the case, and leaves the impression that the railway company had no case, outside of the above testimony. Such space as you give to the defendant's experts is carefully selected and incompletely reported testimony, skillfully handled to strengthen the plaintiffs' suit, and the whole article was written, evidently, with the intention of assuming that there was only one side to the case, and that, the plaintiffs'. Knowing that you would not intentionally publish an article if you had any idea of its incorrectness, we take the liberty of offering the following explanations of the case, as considered from the railway company's side:

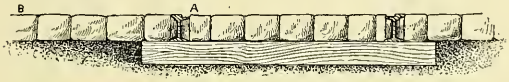


FIG. 1.

First, the most important point, which appears to be evaded by the plaintiffs' experts, is that the questions under consideration are to be taken merely in respect to their bearing on this particular case. The only point in the construction of the road which it was necessary for the railway company to prove is that the track as previously and at present operated is not a "source of danger" to the public, and the question as to whether the system is an economical method for the railway company to operate is not to be considered at all.

As regards the question of bonding and the plaintiffs' experts' testimony to the effect that poor bonding was the cause of track leakage, it is only necessary to compare the result obtained at the point on the track that this case depended on, and the leakage found on heavily bonded tracks of recent construction.

The second point is that the evidence given by the plaintiffs' experts that the difference of potential existing at the two points where the horse stood (at the rail, and 4 feet 6 inches from the rail) is directly proportional to the number of cars operating on the section of line beyond this point from the power house.

The plaintiffs' experts had opportunities for making tests under variable conditions at the point in question, and they were unable to get at any time a reading above 1½ volts between the rail and the water pipe, and less at the point where the testimony showed the horse stood, consequently to obtain the necessary current to shock a horse it was considered advisable by the plaintiffs' experts to introduce the misleading assertion made as regards the increase of potential at *A*, *B*, Fig. 1, being proportional to increased number of cars operating.

Less than one volt was the maximum voltage obtained by test between the track and the point *B* under any conditions of operation, with from one to thirteen cars. The leakage was not in any way proportional to the number of cars operated, and the variation in potential between the points considered when one was operating and when thirteen were operating was scarcely appreciable.

There is one point, however, which appears to have been overlooked by the experts on the other side, and that is when the cars were operating near that point the difference of potential between *A* and *B*, Fig. 1, was greater than when the cars were more distant; in other words, the difference of potential varied inversely as the car distance from *A*, and not directly with the car quantity. Fig. 1 shows *A*, one rail of the track where the plaintiffs testified the horse's hind feet were in contact, and *B* a point on the surface of the ground approximately 4 feet 6 inches from the rail, where the horse's front feet were. The maximum potential between *A* and *B* was less than one volt under defendants' experts' tests, made especially to determine if the difference of potential varied or was proportional to the number of cars operated.

The third point made by the plaintiffs' experts was that the horse would be more liable to receive a shock when the ground was damp.

To illustrate the liability to shock when ground is wet compared with the liability when dry, Prof. Moore, in his testimony for the defence, illustrated by model that under the conditions existing which might cause a shock, that the liability to shock would be less when the ground was saturated or very wet than when dry. To illustrate this he made the following experiment: In Fig. 2, *A* is a shallow metallic pan nearly full of sand, *B* a plate or iron resting on the surface of same, and *C* an ordinary magneto with terminals connected to *B* and *A*. When the sand in *A* was dry and a person touched the place *B* with one hand and any part of the pan *A* with the other, he would receive a shock when the magneto was operated. When the sand was thoroughly dampened and all other conditions unaltered, there was no shock experienced, proving that the liability to shock was less in damp weather. The person spanning *B* and *D*, Fig. 2, is in a similar relation to the sand or earth, as that in which a horse would be, when standing with one foot on the rail and one foot at the point *B*, Fig. 1. It was during the cross-examination of this apparatus that the plaintiffs' attorney, at the suggestion of the plaintiffs' expert, requested the witness to place himself in the following position, Fig. 3, to prove just the reverse of Prof. Moore's testimony. The letters *A*, *B*, *C* and *P* indicate the different parts of the model, the same as in Fig. 2, with the exception that the witness *P*, was requested to place himself in between the magneto and the plate *B*, a condition that does not exist at all in the case under consideration, and was apparently merely a trick to influence the jury. In Fig. 2, the position of *P* is identical to that of the horse, with the horse between *A* and *B* and the intervening earth as a shunt to the horse. In Fig. 3 the witness is put directly in series with the

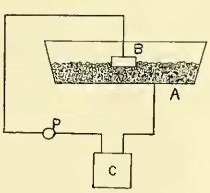


FIG. 2.

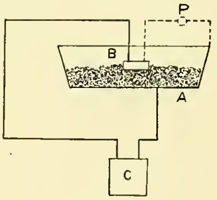


FIG. 3.

magneto and the earth between the two points under consideration. In other words, it makes a false condition, merely confusing the jury as to the worth of the experiment shown by Prof. Moore. Any one can clearly see the motive of the suggestion made by the plaintiffs' expert that witness place himself in the position of Fig. 3. It was simply a questionable advantage taken of the jury's ignorance of electrical conditions and needs no explanation.

As any one acquainted with the railroad business knows, it is a very hard matter to explain to a jury in a popular and simple way an electrical condition existing, and prove to them that such a condition is not a danger to the public or property.

The fact that the plaintiffs' experts were, at any time, unable to discover sufficient potential at the points under consideration to shock a horse, is evidence that the leakage at this point was not dangerous. The whole question was purely one of street railway engineering, and the evidence clearly showed that the experts were unable to prove the horse received a shock without introducing fictitious conditions or basing conclusions on false assumptions.

The article in your recent edition is evidently written by one interested on the side of the plaintiffs, so we feel sure that you will allow us this opportunity to explain several points which have evidently been intentionally omitted in the report.

As the whole case rested on the few points enumerated it will be unnecessary to go into the details of the other evidence outside of that of the expert testimony. Any engineer who has made tests to determine the condition of the water pipe system, or the surrounding earth, relative to the track, appreciates that the complex condition existing under the earth is such that no fixed rule applies as regards to the difference of potential existing at any two points *A* and *B* and its direct bearing on the number of cars operated. The difference of potential at *A* and *B* is not necessarily caused by a leakage at *A*. In many instances testing from *A* to *B*, Fig. 1, the potential difference existing at *AB* in most cases is not directly due to leakage at *A*, but rather to the condition of the various conductors underneath the ground, and when readings are taken between *A* and *B* it may give the result of leakages along the line at different points, or a combined number of leakages along the line. For instance, a water pipe passing beneath the track at some distance from *A*, say ½ mile, and at this point near the track, then running parallel to the track and through the ground, below *B*, producing a potential at *B* relative to *A*, which would not be varied in direct proportion to the amount of current passing along the rail at *A*, but dependent on the relative drop in the rail to the drop in the water pipe and a complex condition of buried conductors. In all the evidence of the plaintiffs' experts it was assumed that the difference of potential existing at *B* was due entirely to leakage from the point *A*, which, as stated above, is a false assumption, proved by actual tests, and plaintiffs' expert testified on the stand that he considered it necessary to prove that there must have been more than 1½ volts between *A* and *B* in order to shock a horse, but was unable to obtain a reading in any case sufficient for the purpose, although he took tests at several times to obtain this.

The point made in the evidence in regard to the fusing point of metals and in regard to the carrying capacity of wires, etc., had no bearing on the case other than its effect on the leakage at this point. The condition of the bonding as testified by the plaintiffs' experts was such as to prove there was a continuous metallic return at this point, and the question of the style of bonding from an engineering standpoint, and consequently commercial standpoint as regards economy of operation, has no bearing on the case whatever. The condition existing along the line clearly proved that the bonding had not produced a condition which was in any way dangerous to animals, and the results obtained were as good as those obtained on roads where the bonding is done with 0000 copper bonds, which the plaintiffs' expert claims should be put in "for public safety."

In the series of models exhibited and described in your paper, the introduction of one model was evidently overlooked, and that was a model in which the plaintiffs' experts were going to prove that a supplementary wire does not assist in carrying any of the current back to the power house, which of course on the face of it does not need any contradiction.

They, however, considered it such an easy thing to prove, that they introduced it during the cross-examination of one of the experts for the defense, but abandoned that line of examination when the testimony proved that the model was misleading and incomplete.

In any suit, expert testimony is Greek to the average juryman, and it is not conducive to a clearer understanding to have experts give spectacular exhibitions under false conditions, in order to destroy evidence which they could not contradict.

Under the most favorable conditions it is a very difficult task for a rich corporation *vs.* a poor man to satisfy a jury that they are neither legally nor morally responsible, and the handicap is more severe when facts are distorted and misleading conditions assumed.

Jungfrau Electric Railway.

It is stated by a writer in a French periodical that the projected trolley line to the summit of the Jungfrau will be finished in time to be opened to the public on June 1, 1900. The cost of the enterprise will be about $1,600,000. There is already a railway to the Scheidegg, at a height of about 6500 feet. This will be utilized in the trolley ascent of the Jungfrau, and the entire length of the line will be about seven miles, of which more than six miles will be by tunnel, in order that the route may be safe from avalanches. From the Scheidegg the line will make for the flank of Mt. Eiger. Within the bowels of the latter the route will turn and extend toward the neighboring Mt. Moech. The first station will be 10,567 feet above sea level. The station on Mt. Moech will be at a height of 11,800 feet.

The terminal station will be under ground and at a height of 13,754 feet. Here will be a restaurant and hotel for travelers. The station will be 220 feet below the actual summit of the Jungfrau. The remaining distance will be accomplished in an elevator. There will be a pavilion on top, whence the tourist may view the mountain and valley below. The height of the Scheidegg, at which the actual ascent of the Jungfrau by trolley will begin, is about 6750 feet, and the journey thence to the summit of the mountain will be made in somewhat more than an hour. Only one car will be despatched at a time. The current will be generated by water power, and an electric plant will be installed next Summer, to aid in boring the tunnels of the proposed line.

A Speed of One Hundred Miles an Hour.

BY G. T. H.

Recent achievements on steam roads have attracted general attention to the interesting question of high speeds on railways. Sixty-five miles an hour is the present limit of speed for trains of several hundred miles, but as steam locomotives have frequently demonstrated their ability to reach 90 miles an hour, under favorable conditions, and as this discussion relates to possibilities in this field, it may be assumed that 100 miles an hour is the speed which at the present time it seems desirable to attain. It is apparent that any vehicle to be propelled at such a rate of speed must be the best, from a mechanical point of view, that human ingenuity can produce. A clear run must also be provided, and the track must also be abandoned exclusively to the flyer. Extra vigilance on the part of switchmen and signalmen will be requisite and an especially well-trained crew must be in charge. At the best the attainment of such a speed must prove expensive, and the train must, therefore, carry passengers and express matter sufficient to make it commercially successful. We are, therefore, justified in assuming that such a train if anything would be heavier than any of the existing flyers.

The recent record of the Lake Shore & Michigan Southern Railway was made with a 92-ton engine drawing a train weighing slightly over 152 tons. It seems no more than fair, however, in view of what has already been said to assume for a speed of 100 miles an hour, a 100-ton engine and a 200-ton train, or a total weight of 300 tons. It will not be unreasonable to assume that the average grade will be 0.5 per cent. It has been found that with very high speeds the traction coefficient is sensibly less than the ordinary 15 pounds per ton, and it has been stated to be as low as 10. Assuming the latter figure to be correct, it is interesting to calculate the necessary horse-power of the locomotive. On level ground the foot-pounds exerted per minute at 100 miles per hour are

$$\frac{300 \times 10 \times 100 \times 5{,}280}{60} = 26{,}400{,}000$$

which divided by 33,000 gives 800 hp. To raise the train on the grade will require

$$\frac{300 \times 2{,}000 \times 100 \times 5{,}280 \times .005}{60} = 26{,}400{,}000$$

or 800 hp more, making a total of 1,600 hp that will be required.

As in locomotive work a margin of power must be allowed, and as the 1,600 hp must be delivered to the tracks over and above all losses, it is fair to assume that the locomotive should have a capacity of 2000 hp. This is more powerful than any electric locomotive in use to-day. With an electric locomotive, however, it would be comparatively easy to attain this power with the prescribed weight.

A popular but mistaken idea exists that electricity is the power to which we must look for the actual attainment of 100 miles per hour. While it is doubtless true that electricity will lend itself more readily to the accomplishment of this end than steam, yet it cannot be stated that it is impossible to attain such a speed with the latter, for the contrary has frequently been proved. The great difficulty attending the use of the steam lies not in the mechanism, but in the conditions. Existing roads are frequently joined by a side track and are crossed at grade. Freight and special trains combine to make such a speed exceedingly dangerous on any railway. Even in the recent triumph of the locomotive on the Lake Shore road, the switches were spiked and the track was kept clear—in fact, extraordinary and complete preparations were made for the test of the fast train. It is just here that electricity shows a superiority, as it will lend itself to safe operation at a speed of 100 miles per hour. An electric railway can be divided into blocks equal in length to the coasting distance that a train would have when traveling at a speed of 100 miles an hour. The electric trains can be so arranged that as one enters a section it will cut off the power from the preceding section, and power will not be available in the latter until the train has entered the second section. By the division of a road into blocks in this way a dead section will always separate trains, and it will therefore be a physical impossibility for them to collide. But this is not all. Should an accident occur to a train on the opposite track and a train be derailed; should a track be broken; a switch be out of repair; a drawbridge be open; in fact, should any contingency liable to cause disaster arise, an arrangement could be devised by which dead sections could be interposed at a sufficient distance from the point of danger to prevent accident. Herein lies an advantage of no small importance. A self-contained locomotive does not possess such an advantage, and, therefore, method of operation. Combining power-houses and distributing system seems likely to offer a more feasible solution. The train dispatcher in this case cannot only command, but can make disobedience a physical impossibility.

While steam is capable of making high speeds, it labors under grave disadvantages when compared with electricity. In the case of the steam locomotive the balance must be perfect. If the centre of gravity is only one-quarter of an inch away from the centre of rotation at a speed of 100 miles an hour, the fault signifies not pounds but tons of strain on the axle, and results in a tendency to vibrate the engine and pound the track. A peripheral speed of 100 miles an hour involves fly-wheel complications and excessive piston speeds. The electric motor possesses the advantage that it is inherently balanced and encounters no friction except that of air and the bearings. The fly-wheel complications exist in both locomotives.

The problem of decreasing wind resistance has been sadly neglected. Any one who stands near a railway station when even a 30-mile-an-hour train is passing notices a tremendous commotion in the air, which raises clouds of dust. A mechanical blower which created such an atmospheric commotion would be found to be one of considerable horse-power. With extremely high speeds the wind resistance becomes greater and its elimination is proportionately desirable. In the construction of vessels the necessity of carefully designed lines both at the bow and stern has been very keenly realized. A careful re-design of locomotives with the same purpose in view will result in a greatly reduced traction coefficient. Assuming that a central station system is to be preferred to a self-contained locomotive, it is interesting to compute the current and voltage that would be necessary. To compete with steam the electric locomotive must not only equal but excel the steam locomotive in economy, otherwise managers will refuse to adopt it. Not more than 10 per cent., therefore, must be lost in the line. The production of 2000 hp requires 1,492,000 watts, and if the voltage is 500 the current will be 2,984 amperes. To transmit this current over any considerable distance at a pressure loss of but 50 volts is out of the question. The current would be sufficient to fuse 0000 wire B. & S. gauge. The transmission of 10,000 volts is perfectly feasible, as is also the transmission of 149.2 amperes at a line loss of 1000 volts. One solution of the problem unquestionably lies in the use of alternating currents and in the perfection of the induction motor.

The Baltimore-Washington Electric Railway.

The Columbia & Maryland Railway Company has undertaken the enterprise of constructing an electric railway between the cities of Baltimore and Washington and the road will probably be completed in about a year. The financial and business management of the project is under the charge of Mr. W. Kesley Schoepf of Washington, and Mr. S. W. Huff is electrical engineer. The company's offices are located in Baltimore. In many ways the railway, which will be approximately 40 miles in length, will be of special interest. In the construction, standard steam railway practice is to be followed. The T-rail which is used weighs 85 pounds to the yard, and was furnished by the Johnson Company of Lorain, O. The joints are bonded by two 0000 B. & S. copper wire which are furnished by the Benedict & Burnham Manufacturing Company.

About 1500 men are now at work on the track, which is being constructed at both the Baltimore and Washington ends of the line. The company has had many obstacles to contend with in obtaining rights of way. In the construction of the line a number of expensive bridges are to be constructed. When all the preliminary difficulties have been overcome, it is stated that a very large force of men will at once be set to work.

Trains of four cars each will be operated, and it is estimated that a loaded train will weigh about 50 tons. The motor-car system will be adopted, and specification will call for a speed of 60 miles an hour on the level stretches. The cars are to be built with cross benches and centre aisles, and the general arrrangement will resemble closely ordinary passenger coaches. It is the purpose of the company to operate both local and express trains, and a very heavy traffic is expected.

The voltage to be used in the operation of the line has not yet been decided upon, but is still under consideration by the engineers. As the use of the ordinary 500-volt system will be attended by many drawbacks, a transmission voltage of 1000 volts has been favored. If the companies which own the patent on the three-wire system are awarded the contract, that system will doubtless be seriously considered. The officers believe that some radical changes from existing methods of transmission are advisable. Current will be furnished from two power stations, one located at Washington and the other at Baltimore. Each plant will have an aggregate capacity of 4000 hp. Specifications for the apparatus and equipment will soon be issued.

A second electric line, having the same terminus and which in a measure will come into competition with that which has just been described, is the Ellicott City electric road, connecting Baltimore and Ellicott. The project is one that is wholly different from the enterprise of the Columbia & Maryland Company, although it has sometimes been confused with the latter. It is stated that this road will be in operation next Spring.

Annual Statement of the Montreal Street Railway.

The annual statement of the Montreal Street Railway Company was presented at a meeting of the stockholders on Nov. 6. The report shows that the company which contributed so generously to the success of the last convention of the American Street Railway Association has been doing a most profitable business. The net profit of the year was $351,349.13, as against $214,021.12 the previous year. The report continues :

"Out of this amount two dividends of four per cent. each have been declared, together amounting to $275,333.33, the balance of $76,015.80 being added to the surplus. From the surplus of last year your directors have paid out a sum of $43,072.89, which extinguishes all old claims against the company, including a large sum payable to the city on account of horse tax, that had been many years in dispute. The company is thus in the position of having cleared off all back liabilities, and now shows a net surplus of $98,586.45.

"Your directors would recommend a careful perusal of the comptroller's report on the other side, which shows very clearly the steady increase in the company's operations. The cost of operating during the entire year averaged 59.20 per cent. of the receipts, as compared with 71.16 per cent. for the previous year, and your directors have every reason to expect that a further decrease in the percentage of operating expenses will be realized during the coming year.

"It is satisfactory, in referring to the statistical statement, to draw your attention to the good result obtained by the conversion of the system to electricity. While the receipts for 1895, as compared with 1892, have grown from $564,406.57 to $1,102,777.57, the operating expenses have only increased $186,166.76, and the net earnings have increased from $97,761.59 to $449,965.83. The number of passengers carried has grown from 11,631,386 to 25,877,758. No other company, your directors can truthfully say, has experienced more gratifying results than these in the conversion of its system to electricity.

"The conversion of the system is completed. The company's repair shops were established at the Côte Street sheds in the Spring of the year, and have been found very convenient, and good work has been turned out from them. The operation of the power house in William Street has been in every way satisfactory.

"The statistical statement is comparative, and includes the years 1892-95, as follows:—Gross receipts, $1,102,777.57 for 1895; $896,090.89 for 1894; $750,751.78 for 1893; and $564,406.57 for 1892. The operating expenses were $652,811.74 for 1895; $637,668.14 for 1894; $593,041.71 for 1893; and $466,644.98 for 1892. The net earnings were $449,965.83 for 1895; $258,422.75 for 1894; $157,710.07 for 1893; and $97,761.59 for 1892. The passengers carried were as follows:—25,877,758 in 1895; 20,569,013 in 1894; 17,177,952 in 1893; and 11,631,386 in 1892 The cars run per day averaged 146 in 1895; 135 in 1894; 117 in 1893 and 80 in 1892.

Street Railway Engineers—XXIV.

J. H. BICKFORD.

Mr. J. H. Bickford, of Salem, Mass., is connected as consulting engineer with a number of well-known traction companies. He was born on a farm in New Hampshire, where he lived until he was 12 years of age. He received a classical high school education, and having a pronounced liking for mechanics devoted himself very energetically to study in this field, both in and out of school. His means, however, did not permit him to obtain a higher education, and he was obliged to relinquish the hope of advanced technical training. From necessity he entered into business, and remained in his position three years, securing excellent, practical commercial training, but at the same time he steadily pursued his mechanical studies when opportunity offered. His distaste for business finally became so extreme, and his desire to enter the engineering field so great, that in 1883 he entered the employ of the Boston & Northern Telephone Company, one of the first organizations of the kind in the country, where he remained nearly three years, receiving the modest salary of $30 per month for the first nine months. Becoming convinced, however, that the line of promotion in the telephone business would not lead to any extended engineering work, he severed his connection with the telephone company, and shortly afterward entered the employ of the Sprague Electric Railway & Motor Company, with which he remained till that company was merged into the Edison General Electric Company. He assisted in the construction of the Richmond, Va., road, and successively installed the roads at St. Joseph, Mo.; Omaha, Neb.; Nashville, Tenn.; Salem, Mass., and reconstructed the work on the West End Railway, of Boston, Mass. After the demise of the Sprague Company he returned to Salem, and after reconstructing the original road, built the remainder of the lines, and accepted the position of Chief Engineer of the system, which he held till 1892, when he determined to go into business on his own account. In September of that year he opened an office in Salem and has been extremely busy since that time, most of his work being outside of New England, although he built the complete plant in Salem for the Lynn & Boston Railway. His work also includes the plants at Reading, Pa.; Scranton, Pa.; and those of the Steinway Railway Company, Long Island City, N. Y.; the Electric Illuminating Company, of the same place; Manchester Street Railway Company, Manchester, N. H.; the Atlantic Highlands, Red Bank & Long Branch Railway Company; North Shore Traction Company, of Lynn, Mass., and others. He is still consulting engineer for several of the companies mentioned. His work has been purely engineering, and he has been very successful in the field.

J. H. BICKFORD.

Free-Transfer System Abolished in Philadelphia.

The liberal free-transfer system which has been in existence in Philadelphia has been abolished, and a system by which eight-cent exchange tickets will be issued has been substituted. It was found that the privileges granted under the old system were abused by the public, especially by the exchange of transfer tickets. A change was contemplated, therefore, as one of the first modifications to be introduced by the Union Traction Company, into which the three great companies have been merged. The official notice of the change is as follows:

"At a meeting to-day, Nov. 1, of the officials of the Union Traction Company, lessee of the Philadelphia Traction Company, and the officials of the People's Traction Company and the Electric Traction Company, it was agreed that, beginning on Monday, Nov. 4, free transfers shall be abolished, but in their place exchange tickets shall be issued for eight cents, interchangeable between said three companies, so that a passenger on any east and west bound line, by paying three cents additional when paying his regular single fare, will be entitled to an exchange ticket, good for a ride on any north or south line, and *vice versa*, if used within one hour from the time punched by the conductor."

Opposition to Electric Freight Line.

The construction of an electric freight line in Hoboken, N. J., has been opposed by a number of property owners in that city. The road is to be built by the Hoboken Railway, Warehouse & Steamship Connecting Company. The case came up for consideration in the Circuit Court in Jersey City last week on a motion that the company should show cause why its ordinance should not be reviewed by a court.

Counsel for the opponents of the road argued that the franchise was granted, not under the street railway act, but under the general railway law, and that there was nothing to prevent the company from running a steam road under the ordinance. He claimed that the ordinance was void because the Mayor and Aldermen had no authority to give the city's streets and a park for the use of a trolley freight line. The defense said that the persons who made the application for the rule had no interest in the matter, as their property did not front on the proposed route of the trolley line. The court reserved decision. The projectors of the road propose to carry freight exclusively, and it is probable that construction will soon commence.

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POSSIBLE CAUSE OF FLAT WHEELS.

It has been stated that a number of large electric traction companies find that the renewal of flat wheels involves an expense of not less than $50 daily. Among the causes which lead to the shortening of the life of the wheel may be the severe arcing that not infrequently occurs between the wheel and the rails. The resulting heating tends to anneal the chilled rim, with the consequence that flat surfaces are produced when the wheel skids. It has been suggested that as a possible remedy forthis evil a steel brush pressing on the head of the rail might be used to reinforce the wheel contact. If such a device could be made practicable it would serve a double purpose; it would keep the contact surface clean and reduce the arcing at the wheels by taking a considerable proportion of the current, and at the same time a saving in power would be effected.

RAPID CONSTRUCTION.

Most of the papers in the country have published within the last few days a dispatch from Chicago describing the rapid construction of an electric railway line in that city. The road in question extends on Indiana Avenue from Thirty-ninth Street to Fifty-first Street, a distance of about one and a half miles. All the overhead material for the construction was in readiness before the equipment of the line was begun, and soon after daybreak a gang of 300 men was set at work. Shortly before 11 o'clock an electric car went over the line. There is no doubt that this was a remarkable performance, but it is not as extraordinary as some of the newspapers have assumed. The equipment of the line from Weehawken to Fort Lee in New Jersey was a much more formidable undertaking, and under the circumstances the rapidity of construction was even more noteworthy. In this case about 100 men constructed four and one miles of overhead line in six days. With the same number of men as were employed in Chicago, 2¼ miles would have been finished per day, a rate of construction somewhat less than that attained in Chicago, but under the existing conditions much more remarkable. In the New Jersey installation it was found necessary to blast rock before the majority of the poles could be set, while in Chicago the holes were dug in soft earth. When speed in construction is under discussion the Nassau Company of Brooklyn could make interesting contributions. After it had received from the General Term a favorable decision allowing it to operate its cars, it completed its construction with extraordinary rapidity and was engaged in carrying passengers regularly within a few hours. Stories to match that sent from Chicago can be picked up in a great many places, and they form the most cherished traditions of the linemen. Speed in construction is oftentimes extremely essential and it sometimes takes unusually good generalship to complete a job in the necessary time, but at the same time the most important thing nowadays in all electric railway departments is not rapid but good construction.

TRANSFER SYSTEMS.

A prominent street railway official made the statement at a convention a year ago that a manager would have been regarded as unfit for his position, who ten or even five years ago ventured to advise his board of directors to introduce a liberal system of transfers. During the last four years, however, there has been a decided change of opinion in this respect. The conviction is now firmly rooted that it pays in dollars and cents to treat the public with extreme liberality. It seems to be generally accepted as the fact that a transfer system is profitable, because it educates the public to ride instead of to walk short distances ; riding becomes the habit and walking the exception. With a public so educated, street railways thrive. Examples of the tendency of companies to extend their transfers systems are to be found almost everywhere ; the most striking illustrations are perhaps to be seen in Brooklyn, where the extension of transfer privileges is now the main dependence of the companies in their efforts to secure traffic. The rental of one great system in Brooklyn which has just been practically effected by another company, has for almost its sole object the organization of a more comprehensive transfer system; extra fares are not to be charged, but the patrons of the leasing company will be enabled to reach important centres not now accessible by its lines. While the tendency is all in the direction of dealing more and more liberally with the public in the matter of transfers, a diametrically different policy has been adopted in Philadelphia. There free transfers have just been abolished and in their place tickets good on intersecting lines are issued on the payment of three cents in addition to the regular fare. The companies which form the new consolidated organization in that city were led to introduce the change because they discovered that the transfer privileges were grossly abused ; trading of transfer slips was found to be a common occurrence. At the same time it was believed that without the transfers the companies were furnishing on continuous lines sufficient transportation for five cents. It is not to be supposed that this change will meet the approval of the public. It is too soon to draw any conclusions from the actual results up to the present time, though the daily papers report a noticeable decrease in traffic. We very much incline to the belief, however, that the change will not prove successful ; eight cents will not be likely to prove a popular fare, even when it includes payment for a second ticket. The success of the plan would be much more probable if a more liberal system had not already been in use. We should not regard as unsafe a prediction that some modification of the new plan in Philadelphia will soon be made in response to a rigorous public demand.

Important Deal in Brooklyn.

It is announced that representatives of the Nassau Electric Railway Company, of Brooklyn, and the Brooklyn Traction Company, have reached an agreement by which the former company is to lease all the lines controlled by the latter. The details of the arrangements have not been made public. That there is a lump sum of money to be paid to the Brooklyn Traction Company is considered certain. One official said it would be $500,000 a year to pay all the fixed charges, and a dividend on both the preferred and common stock. Another is quoted as saying that a less sum would be paid the first year, but that after that the annual rental would be a half a million a year. It is probable that nothing definite will be known until the lease is submitted to a stockholders' meeting. It has also been said that besides assuming the fixed charges aggregating $290,000 yearly, it will pay about 4½ per cent. on the preferred stock and perhaps 1 per cent. on the common stock. The deal is perfected so far as the representatives are concerned and it is not questioned that their action will be approved by the stockholders. The capital of the Brooklyn Traction Company is $6,000,000 common stock, $3,000,000 6 per cent. preferred stock, and it controls the Atlantic Avenue system with 42 miles of tracks and the Brooklyn, Bath & West End Railroad with 13 miles of track.

When the formalities are concluded the two roads will be operated as one. There will be no extra fares charged for traveling over the two lines, but a uniform rate of five cents will be charged from any section of Brooklyn to any other part. Connections will be made between the different lines of the two companies as rapidly as it is possible. Direct routes will be made between all the ferries and the bridge to the terminals of the Nassau's lines at the West End, Brighton, Manhattan, Fort Hamilton and Canarsie. Where through cars are not operated transfer stations will be started, and as soon as the travel will warrant through cars they will be run. In addition to the making of these connections the Nassau Company will agree in its lease to expend before next July $500,000 on the property of the Brooklyn Traction Company. That will be a part of the guarantee of the payment of the dividends with promptness. If at any time there is a default the property is to revert to the Brooklyn Traction Company with all of its improvements.

Storage Batteries to Be Introduced by New Owners of Chicago Lines.

It is announced that the control of the Inglewood & Chicago Electric Railway Company, and the Chicago & Morgan Park Street Railway Company has passed into the hands of J. C. Shaffer, as representative of a syndicate, the members of which control the Electric Storage Battery Company, of Philadelphia. The authorized capital stock of the Englewood & Chicago line is $2,500,000, but only $300,000 of this has been issued. It was controlled by W. V. Jacobs, who also controls the Morgan Park Company, capitalized at $2,000,000. Nothing has been done with the latter since the franchise was granted.

Mr. Shaffer states that important extensions will be made, improvements will be introduced, and that the system will be operated by storage battery cars.

Electric Car Tests.

BY HERMANN S. HERING, M.E.,
Assisted by
CHARLES REUTLINGER and B. HARRISON BRANCH.

(Continued from page 340.)

VI.—PERFORMANCE OF CARS IN REGULAR SERVICE.

This series of tests was made for the purpose of obtaining characteristic data from cars running in regular service. The same cars were used as in the other tests, but they were equipped simply with a Boyer speed recorder and a Thomson wattmeter which were placed in such a way as not to interfere with the seating capacity. The cars were put in regular service on the roads, readings being taken at the beginning and end of each trip, and any unusual delays were noted. A large number of records was obtained, of which those given were selected as showing the average conditions. Table 11 contains the results of these tests, and the data is given in the same general form as in the other tests, except that in addition the total and mean values are given where feasible. The first test given is that of car No. 64, one of those used in the previous tests, and it was operated between Roland Park and City Hall, the seven records obtained being the consecutive runs during the afternoon and evening. The first three runs were made by one motorman and the last four by another, each of them operating the car in the usual manner, as they were ignorant of what tests were being made. In comparing these trips, the variations of the watt-hours, number of stops and passengers can be seen. The average speed from Roland Park to City Hall, which is down grade, is 13.4 miles an hour, and from City Hall to Roland Park, up grade, is 13.6 miles per hour, a rather unusual result, as the difference in height between the two terminals of the road is nearly 400 feet. The average number of stops for the going and return trips is 16 and 18, respectively, a little over three stops per mile, and the number of passengers carried, 13 and 15, respectively. The average electrical horse-power used on the round trip was 17.23, and the watt-hours per car-mile, 1167. The speed records of these regular runs are given in Fig. 32, and are plotted on the track data and profile as a base in the same manner as before described; these curves, which were reproduced from the original records, show the typical character of the running, and by referring to the track data below, the causes of many of the stops and slackenings can be seen.

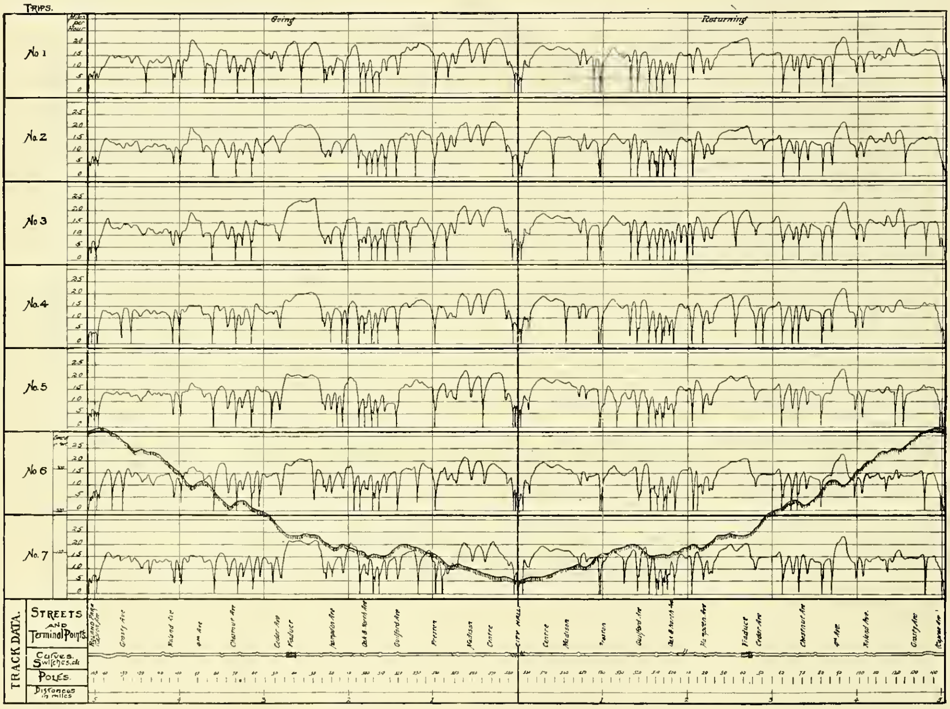


FIG 32.—SPEED RECORDS OF CAR NO. 64 DURING REGULAR SERVICE
ON THE ROLAND PARK ROAD, AUG. 20, 1894.
DETAILED DATA IN TABLE 11.

The second portion of Table 11 shows the results obtained from four consecutive runs on the Huntingdon Avenue line of the Baltimore Traction Company. This line runs from the northern portion of Baltimore through the city to the extreme southern portion on the Patapsco River, a typical record of which has already been given in Fig. 31. The speed records of these runs are plotted in Fig. 33, but as the poles were not numbered and the profile of the road was not available, the track data given in the figure is limited to the scale of distances, the curves on the road and the names of the principal streets. The number of stops made on this run, 75, is about seven stops per mile. The average speed is about

12 miles per hour going and 11 returning, and the road contains probably the smallest grades of all of these roads. The large difference between the speed as calculated from the time interval and distance and the integrated value is due mainly to the fact that the time for stopping to take on passengers was not noted, and the calculated speed, therefore, includes stops, whereas the integrated speed does not. The watt-hours per car-mile per round trip is 1290, which is a good average value for a city run of this character.

TABLE 11.—OBSERVED AND COMPUTED RESULTS OF THE PERFORMANCE OF VARIOUS ELECTRIC CARS IN REGULAR SERVICE.

SPEED RECORDS AND TRACK DATA PLOTTED IN FIGS. 32, 33, 34, 35 AND 36.

Routes and Cars.	Trip Number.	GOING.															RETURNING.															ROUND-TRIP.							
			TIME.				Mean Speed miles per hour.					STOPS.						TIME.				Mean Speed miles per hour.					STOPS.							Mean Speed miles per hour.					
		Distance going.	Leaving.	Arriving.	Delays.	Net Time Interval.	Calculated from time interval	Integrated.	Watt-hours from Wattmeter.	Watt-hours per Car-mile.	Mean E.H.P. from Wattmeter.	Full	Partial (3 m.p.h. or less)	Total.	Passengers.	Remarks.	Distance returning.	Leaving.	Arriving.	Delays.	Net Time Interval.	Calculated from time interval	Integrated.	Watt-hours from Wattmeter.	Watt-hours per Car-mile.	Mean E.H.P. from Wattmeter.	Full	Partial (3 m.p.h. or less)	Total.	Passengers.	Remarks.	Distance.	Net Time Interval.	Calculated from time interval	Integrated.	Watt-hours from Wattmeter.	Watt-hours per Car-mile.	Mean E.H.P. from Wattmeter.	Motormen.
1	2	3 o	4 o	5 o	6 o	7 c	8 c	9 c	10 o	11 c	12 c	13 o	14 o	15 o	16 o	17	18 o	19 o	20 o	21 o	22 c	23 c	24 c	25 o	26 c	27 c	28 o	29 o	30 o	31 o	32	33 c	34 c	35 c	36 c	37 o	38 c	39 c	40
			H. M. S.	H. M. S.	M. S.	H. M. S.												H. M. S.	H. M. S.	M. S.	H. M. S.												H. M. S.						
ROLAND PARK AND CITY HALL. Aug. 20, 1894. CAR 64 Equipment: 2-25 H.P. "GE 800" motors, "K" controllers Single Truck, "Lord Baltimore No. 2" Weight of Car, 14715 lbs.	1	5.09	3 36 30 P.M.	4 3 30 P.M.	—	27-0	11.3	13.6	3158	622	9.41	15	1	16	16½	—	5.03	4-8-0 P.M.	4-31-15 P.M.	—	25-15	11.9	14.5	8205	1632	26.08	15	1	16	16½	—	10.12	52-15	11.6	14.0	11363	1123	17.49	Marshall
	2	″	4-44-30	5-7-15	—	22-45	13.4	13.6	3158	822	11.16	10	3	13	8	—	″	5-8-20	5-41-40	—	33-20	9.1	13.1	8478	1685	20.45	18	0	18	26	—	″	56-5	10.8	13.2	11656	1150	16.70	″
	3	″	5-51-45	6-19-35	—	27-50	11.0	13.1	3362	661	9.72	14	2	16	16	—	″	6-21-15	6-48-30	—	27-15	11.1	13.3	8850	1760	26.10	17	2	19	24½	—	″	55-5	11.0	13.3	12212	1207	17.63	″
	4	″	6-59-0	7-28-40	—	29-40	10.3	13.0	3590	706	9.74	17	2	19	13	Changed Crew	″	7-30-0	7-58-30	—	28-30	10.6	13.1	8520	1694	24.03	18	4	22	13		″	58-10	10.4	13.1	12110	1196	16.75	Lutz
	5	″	8-7-30	8-34-50	—	27-20	11.2	13.8	3522	692	10.36	17	1	18	10	—	″	8-37-30	9-4-0	—	26-30	11.4	13.8	8010	1592	24.30	16	2	18	9	—	″	53-50	11.3	13.8	11532	1139	17.25	″
	6	″	9-13-30	9-41-30	—	28-0	10.9	13.7	3635	714	10.43	15	3	18	7	—	″	9-43-30	10-10-45	—	27-15	11.1	13.6	8240	1638	24.30	16	2	18	8	RAINING.	″	55-15	11.0	13.6	11875	1173	17.30	″
	7	″	10-20-45	10-52-40	3-0	28-55	10.6	13.3	3738	735	10.38	11	2	13	18	Delayed by broken wagon	″	10-55-0	11-20-50	—	25-50	11.7	14.0	8138	1617	25.30	14	4	18	11	—	″	54-45	11.1	13.6	11876	1173	17.47	″
	Totals	35.63	—	—	—	3-11-30	—	—	24163	—	—	99	14	113	90½	—	35.21	—	—	—	3-13-55	—	—	58441	—	—	114	15	129	—	—	70.84	6-25-25	—	—	82604	—	—	—
	Mean	5.09	—	—	—	27-21	11.2	13.4	3452	678	10.15	14	2	16	13	—	5.03	—	—	—	27-42	10.9	13.6	8349	1659	24.25	16	2	18	15	—	10.12	55-4	11.0	13.5	11801	1167	17.23	—
HUNTINGDON AVE. AND FERRY BAR. Oct. 11, 1894. CAR 314 Equipment (see below)	1	5.31	1-29-0 P.M.	2-3-50 P.M.	—	34-50	9.1	13.0	5850	1102	13.51	25	8	33	26	—	5.28	2-6-0 P.M.	2-46-15 P.M.	—	40-15	7.9	11.6	7610	1443	15.20	30	6	36	33	—	10.59	1-15-5	8.5	12.3	13460	1271	14.42	
	2	″	2-47-0	3-21-25	—	34-25	9.3	11.5	4650	876	10.86	18	14	32	20	—	″	3-24-30	4-3-40	—	39-10	8.1	11.3	8500	1610	17.45	28	11	39	40	—	″	1-13-35	8.6	11.4	13150	1242	14.38	
	3	″	4-4-45	4-41-0	—	36-15	8.8	12.5	5225	985	11.60	24	10	34	38	—	″	4-41-35	5-20-0	—	38-25	8.2	10.6	7965	1509	16.68	25	12	37	33	—	″	1-14-40	8.5	11.3	13190	1246	14.22	
	4	″	5-21-55	6-1-15	—	39-20	8.1	13.3	5940	1120	12.15	36	7	43	34	—	″	6-2-0	6-42-0	—	40-0	7.9	10.5	8930	1692	17.96	38	5	43	50	—	″	1-19-20	8.0	11.8	14870	1405	15.08	
	Totals	21.24	—	—	—	2-24-50	—	—	21665	—	—	103	39	142	118	—	21.12	—	—	—	2-37-50	—	—	33005	—	—	121	34	155	159	—	42.36	5-2-40	—	—	54670	—	—	—
	Mean	5.31	—	—	—	36-12	9.0	12.8	5416	1019	12.02	26	10	36	30	—	5.28	—	—	—	39-26	8.0	11.0	8251	1561	16.62	30	9	39	40	—	10.59	1-15-40	8.4	11.7	13667	1290	14.53	—
LINDEN AVENUE. Oct 6, 1894. CAR 314 Equipment: 2-25 H.P. No 3 Westinghouse motors "G" controllers. Single Truck, "Bemis." Weight of Car, 16020 lbs, actual.	1	2.615	2-11-0 P.M.	2-33-0 P.M.	—	22-0	7.1	10.0	1931	739	7.05	12	5	17	17	—	2.785	2-33-0 P.M.	2-56-0 P.M.	—	23-0	7.3	9.0	4430	1591	15.50	17	5	22	3	—	5.4	45-0	7.2	9.5	6361	1178	11.38	
	2	″	2-56-0	3-27-0	—	31-0	5.1	10.1	2983	1140	7.75	26	5	31	38	—	″	3-27-0	3-48-0	—	21-0	8.0	10.5	5083	1826	19.47	19	5	24	12	—	″	52-0	6.2	10.3	8066	1495	12.49	
	3	″	3-48-0	4-12-0	—	24-0	6.5	9.7	2307	882	7.74	17	6	23	16	—	″	4-12-0	4-35-0	—	23-0	7.3	9.4	5456	1960	19.07	22	1	23	13	—	″	47-0	6.9	9.5	7763	1438	13.29	
	4	″	4-35-0	4-59-0	—	24-0	6.5	10.6	2341	896	7.86	20	3	23	9	—	″	4-59-0	5-22-0	—	23-0	7.3	8.7	5820	2091	20.75	21	8	29	31	—	″	47-0	6.9	9.6	8161	1512	13.97	
	5	″	5-22-0	5-44-0	—	22-0	7.1	9.7	2170	830	7.94	12	3	15	9	—	″	5-44-0	6-8-0	—	24-0	7.0	9.1	6420	2305	21.52	24	4	28	35	—	″	46-0	7.0	9.4	8590	1591	15.02	
	6	″	6-8-0	6-26-0	—	18-0	8.7	10.7	2420	926	10.81	12	8	20	10	—	″	6-26-0	6-47-0	—	21-0	8.0	10.2	4700	1687	18.0	16	7	23	23	—	″	39-0	8.3	10.4	7120	1318	14.66	
	7	″	6-47-0	7-11-0	—	24-0	6.5	9.2	2500	956	8.[illegible]	19	4	23	8	—	″	7-11-0	7-34-0	—	23-0	7.3	8.5	4430	1591	15.5	17	5	22	3	—	″	47-0	6.9	6.8	6930	1285	11.66	
	Totals	18.305	—	—	—	2-45-0	—	—	16652	—	—	118	34	152	107	—	19.495	—	—	—	2-36-0	—	—	36341	—	—	13[illegible]	3[illegible]	173	12[illegible]	—	37.8	5-23-0	—	—	52993	—	—	—
	Mean	2.615	—	—	—	23-34	6.7	10.0	2379	910	8.13	17	5	22	15	—	2.785	—	—	—	22-34	7.4	9.4	5192	1862	16.5	20	5	25	17	—	5.4	46-8	7.0	9.6	7571	1402	13.18	—
Preliminary Run. Nov. 2nd	~	6.80	2-50-0 P.M.	3-19-20 P.M.	1-15	28-5	14.5	16.7	5320	783	15.8[illegible]	5	0	5	4	Car was running using minimum current	6.86	3-33-30 P.M.	4-0-10 P.M.	0-55	25-45	16.0	17.3	2420	353	7.57	3	0	3	4	Car was running using minimum current	13.66	53-50	15.2	16.8	7940	561	11.86	Hoffman
BALTIMORE AND PIKESVILLE. Nov 3, 1894. CAR 234 Equipment. 2-25 H.P. No 3 Westinghouse motors "G" controllers Single Truck, "Bemis" Weight of Car, 15950 lbs (actual) USUAL SERVICE FOR ONE DAY.	1	6.80	5-33-35 A.M.	6-40-45 A.M.	39-40	27-30	14.8	17.6	6160	909	18.08	5	1	6	9	Delayed by broken trolley wire	6.86	6-41-15 A.M.	7-6-0 A.M.	—	24-45	16.6	19.7	3660	534	11.90	6	7	13	15	—	13.66	52-15	15.7	18.6	9840	721	15.16	Morton
	2	″	7-6-15	7-34-15	—	28-0	14.6	17.1	6560	965	18.87	7	2	9	10	Raining Track slippery [illegible]	″	7-35-0	7-59-45	—	24-45	16.6	19.7	3390	494	11.02	8	1	9	15	Weather clear. Track [illegible]	″	52-45	15.5	18.5	9950	729	15.17	″
	3	″	8-3-20	8-30-0	—	26-40	15.3	16.8	5840	859	17.61	4	0	4	6	—	″	8-33-45	9-0-0	—	26-15	15.7	19.2	5020	586	15.38	8	5	13	31	—	″	52-55	15.5	16.0	10860	795	16.50	″
	4	″	9-3-30	9-31-45	—	28-15	14.4	16.7	6730	990	19.17	5	2	7	6	—	″	9-33-52	10-1-30	—	27-38	14.9	19.1	3630	529	10.57	13	0	13	3½	—	″	55-53	14.7	17.8	10360	759	14.90	″
	5	″	10-3-30	10-33-0	—	29-30	13.8	16.0	7490	1102	20.4[illegible]	11	2	13	10	—	″	10-34-0	10-59-45	—	25-45	16.0	19.5	3685	537	11.51	10	1	11	20	—	″	55-15	14.8	17.7	11175	819	16.20	″
	6	″	11-5-0	11-32-0	—	27-0	15.1	16.5	7553	1111	22.51	8	1	9	16	—	″	11-34-0 A.M.	12-0-0 P.M.	—	26-0	15.8	20.3	3180	464	9.82	5	2	7	9	—	″	53-0	15.7	18.4	10733	786	16.29	″
	7	″	12-0-10 P.M.	12-30-25 P.M.	1-35	28-40	14.2	16.2	7710	1134	21.[illegible]	5	3	8	9	Delayed by Repair Car	″	12-31-30	12-55-20	—	23-50	17.3	20.6	3070	448	10.3[illegible]	6	2	8	12	—	″	52-30	15.7	18.3	10780	789	16.62	Kelly.
	8	″	1-0-0	1-28-30	—	28-30	14.3	15.9	7820	1150	22.08	3	4	7	14	—	″	1-30-[illegible]	1-55-[illegible]	—	25-50	15.9	19.8	3360	490	10.46	8	5	13	14	—	″	54-20	15.1	17.7	11180	818	16.5[illegible]	″
	9	″	2-1-0	2-32-0	2-10	28-50	14.1	15.9	7810	1149	21.8[illegible]	6	4	10	14	Delayed by Repair Car	″	2-33-0	2-56-10	—	23-10	17.7	20.[illegible]	3560	519	12.36	4	6	10	15	—	″	52-0	15.8	18.3	11370	832	17.6[illegible]	″
	10	″	3-0-0	3-28-45	—	28-45	14.2	16.3	7760	1142	21.72	9	1	10	24	—	″	3-30-0	4-0-45	—	30-45	13.4	20.[illegible]	3210	468	8.42	9	1	10	17	—	″	59-30	13.8	18.4	10970	803	14.8[illegible]	″
	11	″	4-2-30	4-31-0	—	28-30	14.3	15.8	8370	123[illegible]	23.[illegible]	10	2	12	26	—	″	4-32-0	4-56-15	—	24-15	17.0	20.2	3965	578	13.18	13	1	14	20	—	″	52-45	15.5	17.9	12335	903	18.8[illegible]	″
	12	″	5-0-10	5-32-0	—	31-50	12.8	16.0	8235	1211	20.8[illegible]	15	1	16	38	—	″	5-32-30	6-0-10	—	27-40	14.9	19.3	4430	646	12.88	14	1	15	66	—	″	59-30	13.8	17.8	12665	927	15.7[illegible]	″
	13	″	6-1-0	6-33-5	—	32-5	12.7	15.1	7930	1166	19.88	10	2	12	36	—	″	6-34-45	6-58-45	—	24-0	17.1	19.6	4310	628	14.4[illegible]	8	0	8	33	—	″	56-5	14.8	17.4	12240	896	16.[illegible]	Moore
	14	″	7-0-30	7-30-0	—	29-30	13.8	16.1	7530	1107	20.5[illegible]	6	3	9	18	—	″	7-31-0	7-57-30	—	26-30	15.5	18.7	3920	571	11.90	8	5	13	30	—	″	56-0	14.6	17.4	11450	839	16.4[illegible]	″
	15	″	8-0-50	8-29-30	—	28-40	14.2	16.4	6900	1015	19.3[illegible]	6	2	8	14	—	″	8-32-45	8-57-15	—	24-30	16.8	19.3	3400	496	11.17	7	1	8	18	—	″	53-10	15.4	17.8	10300	754	15.5[illegible]	″
	16	″	9-0-15	9-28-45	—	28-30	14.3	16.8	6430	946	18.14	5	1	6	12	—	″	9-30-45	9-56-15	—	25-30	16.1	18.2	2610	381	8.24	4	1	5	6	—	″	54-0	15.2	17.5	9040	662	13.48	″
	17	″	10-0-45	10-31-30	—	30-45	13.3	16.0	7600	1118	19.88	9	7	16	24	—	″	10-32-45	10-57-45	—	25-0	16.9	19.1	3300	481	10.6[illegible]	4	3	7	6	—	″	55-45	14.7	17.5	10900	796	15.[illegible]	″
	18	″	11-1-15	11-31-4[illegible]	—	30-33	13.3	18.0	7280	1071	19.17	9	3	12	29	—	″	11-33-0	11-57-[illegible]	—	24-0	17.1	19.1	3040	443	10.2[illegible]	3	2	5	3	—	″	54-3[illegible]	15.0	17.5	10320	7[illegible]	15.[illegible]	″
	Totals	122.4	—	—	—	8-42-9	—	—	131790	—	—	13[illegible]	41	17[illegible]	30[illegible]	—	123.48	—	—	—	7-40-2[illegible]	—	—	6474[illegible]	—	—	13[illegible]	44	1[illegible]2	36[illegible]	—	245.88	16-22-2[illegible]	—	—	96470	—	—	—
	Mean	6.8	—	—	—	29-0	14.1	16.3	7318	107[illegible]	20.3	7	2	9	17	—	6.86	—	—	—	25-34	16.1	19.6	359[illegible]	524	11.9[illegible]	8	2	10	20	—	13.6[illegible]	54-[illegible]	15.0	17.9	1091[illegible]	800	16.10	—

Car Weights and Equipments:

Car No.	Company	Kind	Weights, actual	Motors.	Controllers	Truck.
234	Balto. Tract'n	Motor	15,800 lbs	2-25 H.P. No. 3 Westinghouse	"G"	Single, Bemis."
314	″	″	15,020	″	″	″
64	Lake Roland	″	14,710	2-25 H.P. "GE 800"	"K"	"Lord Baltimore No. 2."

Explanatory: o at the head of a column means observed values.
c " " " " " " computed "
Time readings taken within 5 seconds
Time of ordinary stops not recorded
Integrated values of speed have a small error due to speed curve being plotted on a distance base, but are truer than the calculated. The difference is due mainly to time and rate of stopping, etc.
Weights of Car and load when in regular service are not given, as load is variable.
Crew not counted as passengers.
Number of stops include one terminal.

Column 7 = Col. 5 − Col. 4 − Col. 6
8 = Col. 3 × 3600 ÷ Col. 7 (seconds)
9 = Integration of Speed Record.
11 = Col. 10 ÷ Col. 3
12 = Col. 10 × 3600 ÷ Col. 7 (seconds) ÷ 746
22 = Col. 20 − Col. 19 − Col. 21
23 = Col. 18 × 3600 ÷ Col. 22 (seconds)
24 = Integration of Speed Record

Column 26 = Col. 25 ÷ Col. 18
27 = Col. 25 × 3600 ÷ Col. 22 (seconds) ÷ 746
33 = Col. 3 + Col. 18
34 = Col. 7 + Col. 22
35 = Col. 33 × 3600 ÷ Col. 34 (seconds)
36 = Integration of Speed Record
38 = Col. 37 ÷ Col. 33
39 = Col. 37 × 3600 ÷ Col. 34 (sec) ÷ 746

The third portion of Table 11 gives the tests made on the Linden Avenue line with the same car, and the speed records are plotted in Fig. 34. This line runs through the business portion of the city, and out into northwest Baltimore. It is a short route—5.4 miles round trip—but the stops, though less in number, are greater per mile of track than on any of the others. The average is 47 stops to the round trip, which is about nine stops per mile, as compared with seven stops on the Huntingdon Avenue line. The average speed is 9.6 miles per hour for the round trip, and the watt-hours per car-mile are 1402, which is so large probably on account of the more frequent stops and the very slow running required along portions of the road. The average grade of this road is, moreover, heavier than that of the Huntingdon Avenue line, which will also account for some of the difference in energy required.

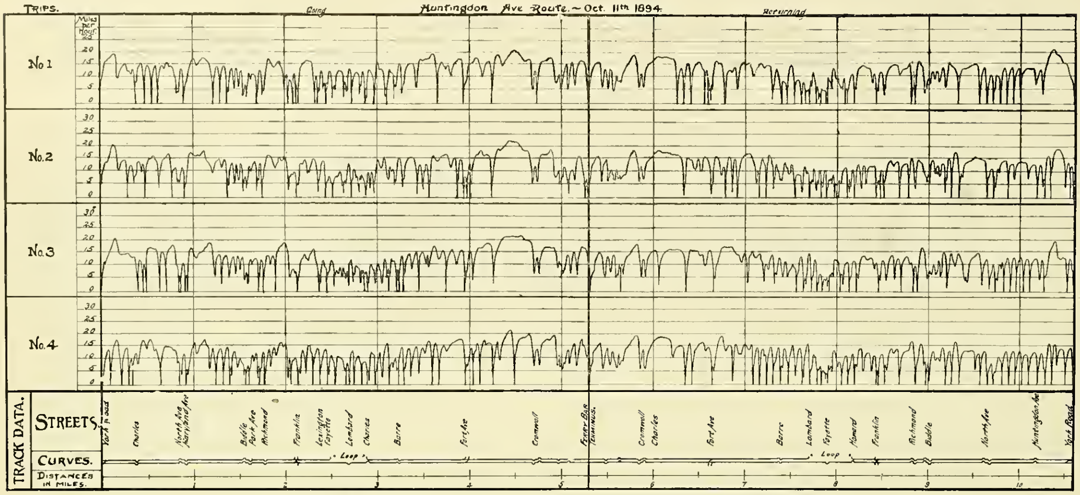


FIG. 33.—SPEED RECORDS OF CAR NO. 34 DURING REGULAR SERVICE
ON THE HUNTINGDON AVENUE ROUTE OF THE BALTIMORE TRACTION COMPANY, OCT. 11, 1894
DETAILED DATA IN TABLE 11.

The fourth portion of Table 11 shows the results of the test of car No. 234, run on the Pikesville road in regular service. This car was run for one entire day, and shows the usual number of trips made and the average result of one day's regular service on this road. This test was made on Nov. 3, 1894, when the Winter schedule was in operation, during which time the cars run every 30 minutes and make the round trip in one hour. In the Summer the cars run about every 20 minutes. This car was the same one that was used on the other Pikesville road tests, and was equipped with the Boyer speed recorder and Thomson wattmeter, the instruments being placed out of the way of the passengers. The actual weight of the car was obtained prior to the test, as usual.

The 18 trips, as shown in the table, contain a great variety of data, but by picking out such runs as have practically the same number of stops and passengers some interesting comparisons can be made. The average speed going was 16.3 miles per hour; returning, 19.6, and the round trip, 17.9; and the average watt-hours per car-mile for the day was 800. The total mileage for the car for the day was 245.88, which is the usual one day's work of the cars on this road.

The average number of stops per car-mile for the day on this road, which is entirely suburban, was about 1.4. The number of full stops was 76 per cent., and partial stops, to a speed of 3 miles per hour or less, 25 per cent. of the total. By way of comparison it may be interesting to notice that on the Roland Park road, which is both a city and a suburban road, there were 3.4 stops per car-mile, the number of full stops, 88 per cent., and partial

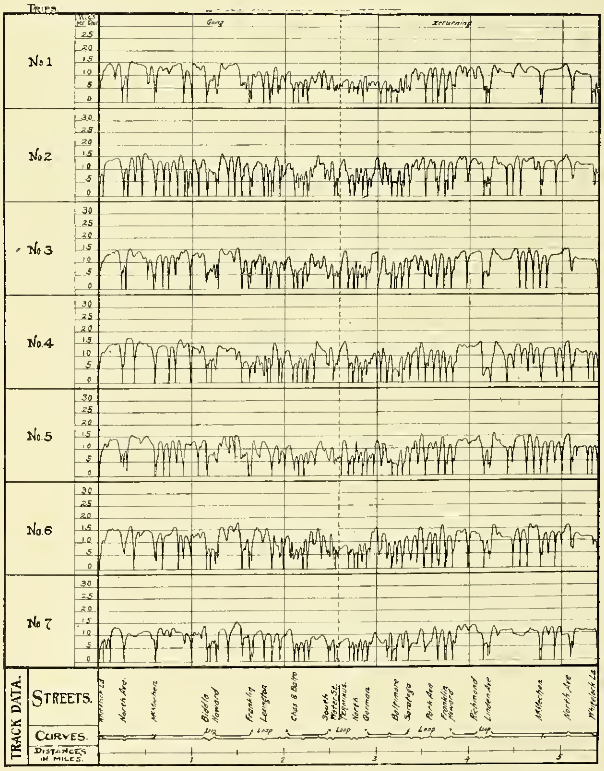


FIG. 34.—SPEED RECORDS OF CAR NO. 314 DURING REGULAR SERVICE
ON THE LINDEN AVENUE ROUTE OF THE BALTIMORE TRACTION COMPANY, OCT. 6, 1894.
DETAILED DATA IN TABLE 11.

stops, 12 per cent. of the total, while on the Huntingdon and Linden Avenue lines, which are typical city roads, the average number of stops per car-mile was 7.8, the full stops 77 per cent., and the partial stops 23 per cent. of the total. These figures can be considered as a fair indication of average practice, unless the conditions are widely different from those under which these results were obtained.

(*To be continued.*)

New Officers in Philadelphia.

The executive committee of the Union Traction Company, of Philadelphia, has decided upon the appointments to the principal positions on the consolidated system. It was decided to organize the consolidated system into four divisions, the People's and Electric systems, as at present constituted, each to form a division, and the Philadelphia Traction system to constitute two divisions. In addition to the superintendents of these four divisions and their subordinate assistants, a corps of superintendents will be maintained to assume general direction of the management of affairs.

General Manager J. R. Beetem, of the People's Traction Company, will be general manager of the system, as has already been announced. The next important position, that of superintendent of transportation, will be filled by James Gorman, who for a number of years has been superintendent of the Philadelphia Traction system. W. S. Twining, at present chief engineer of the People's Traction Company, will occupy the same responsible position with the Union Company, and Charles Hewitt, at present with the Electric Traction Company, will be chief electrician. W. J. Kerr, of the Electric Traction Company, is to be superintendent of motive power, and N. B. Nichols and S. T. Lincoln, both at present with the People's Traction Company, are to be superintendent of subways and overhead construction, respectively. Superintendent E. H. Shaufler and Master Mechanic William H. Wampler, of the People's Traction Company, are to be continued in the positions of superintendents of the rolling stock. Nelson Sailer is to act as general claim agent for the company.

One division of the Philadelphia Traction Company is to have its headquarters at Fifteenth and Cumberland Streets, with Walter Ellis as superintendent, and the other division, with headquarters at Forty-first and Haverford Streets, in West Philadelphia, will have W. H. Whiting as superintendent. Harry Miller will be superintendent of the People's Traction division, with headquarters at Eighth and Dauphin Streets, and J. D. Benson will be superintendent of the Electric Traction division, with headquarters at Kensington Avenue and Cumberland Street. The new officers are to assume their new positions, it is stated, on Dec. 1.

American Machinery to Be Introduced in France.

The Walker Manufacturing Company, of Cleveland, has made a contract with a French syndicate, in accordance with the terms of which the Walker electrical machinery is to be introduced on a large scale in Europe. The agreement on the part of the French capitalists was signed by F. De la Briere and C. La Blanc, who have been in Cleveland some little time conducting negotiations with the Walker Company. M. La Blanc formerly was one of the European electrical engineers of the General Electric Company. He resigned that position in order to associate himself with the syndicate. M. De la Briere is a representative of the Escaut & Meuse, the largest tube works in France, which also has branch works in Russia. In reference to the purposes of the French syndicate, Mr. La Blanc recently said: "Immense fortunes have been made in this country, as every one knows, by buying up old horse systems and rehabilitating them and transforming them into electric car lines. This is just what we intend to do in Europe. We have already secured eleven new concessions or franchises, and as our syndicate contains some of the most responsible institutions in France we anticipate little trouble in securing all of the privileges we want. In Europe it is not necessary to pay city councilmen in order to secure franchises. People there are very progressive and are ready to invest in any scheme that seems to be sound. In addition, the syndicate we represent will sell the Walker appliances to others wanting them. A feature of this deal is the fact that we can buy American electrical machinery, pay duties on it at the rate of 45 cents per kilos and sell it cheaper than the European article, and the American article is by far the superior of the two."

Hatch Storage Battery.

An exhibition of the Hatch storage battery took place in Philadelphia last week, and the results are said to have been entirely satisfactory to the members of the company. It is claimed that the batteries have been successfully used for streetcar propulsion. It is stated a car equipped with batteries has been run continuously for months. The battery was invented by George E. Hatch, of Quincy, Mass., in 1890, and is covered by United States patents. Since the invention continuous experiments have been made with the battery, both in the laboratory and in practical work, and it is now manufactured by the Hatch Storage Battery Company, of Philadelphia.

Mr. Hatch uses light, porous earthenware plates and places the active material upon them, clamping and binding the plates together by means of light wooden boards and flexible rubber bands. Between the earthenware plates are very thin lead sheets provided with lugs at the top which serve to form electrical connection between the elements. The advantages claimed for this method of construction are greater strength, lightness, elasticity—to allow for expansion and contraction—and the positive security and stability of the active material. It is claimed that the battery is entirely unaffected by the jolting of street cars and railway trains, and that extremely heavy discharge rates do not affect its life or cause its depreciation.

Class in Electricity.

The employees of the Brooklyn Heights Railway Company have organized a class of the National School of Electricity. About 45 have decided to attend the meetings which will be held on Wednesday evenings at Johnson's Hall. Among those who have joined the class are Mr. Whittlesey, superintendent of motive power; Mr. Vandeveer, superintendent of shops, and Mr. Livermore, general instructor of motormen.

FINANCIAL NOTES.

HALIFAX, N. S.—The street railway has been sold by the sheriff for $25,000 to the Electric Railway Company.

MONTREAL STREET RAILWAY, in its annual report, puts gross earnings at $1,101,204 and net earnings at $443,392.

TRACTION EARNINGS.—New Orleans Traction Company reports an increase in October earnings of $27,074. North Shore Traction Company's October receipts show an increase of $3,835.

LANSING CITY RAILWAY MORTGAGED.—The Lansing City Street Railway Company, Lansing, Mich., has filed a mortgage deed to the Continental Trust Company, of New York, for $100,000.

PEOPLE'S TRACTION TO REDUCE ITS CAPITALIZATION.—The stockholders of the People's Traction Company, Philadelphia, have decided to reduce the capital stock from $10,000,000 to $6,000,000, in accordance with the ruling of the act of Assembly governing capitalization of street railways.

NEW INCORPORATIONS.

SCRANTON, PA.—The Dunmore Street Railway Company has been formed to build an electric railway by Frank Silliman, Jr., Horace E. Hand and Robert P. Fox, Scranton, Pa. Capital stock, $30,000.

BUFFALO, N. Y.—The Buffalo Traction Company has been formed for the purpose of constructing and operating an electric street railway. Those interested are E. C. S. Miller, J. B. Mayer, Buffalo, N. Y.; T. L. Johnson, Cleveland, O., and J. K. Page, New York City, N. Y. Capital stock, $3,000,000.

BOULDER, COL.—The Western Electric Transit & Power Company, capital stock, $100,000, has been incorporated to construct and operate an electric street railway in Boulder County. The promoters are Edwin B. Goodwin, H. J. Danford, W. K. Mebollin, Bernard Mallor, Frank Kline, Oliver J. Cheney, Boulder, Col.

JERSEY CITY, N. J.—The Newton Traction Company has been formed to contract for and build street railways, electric railways and electric light and power systems. Those interested are Horace B. Parker, Newton, Mass.; Louis Pfingst, Boston, Mass.; Frank P. Hillyer, New York City, and John N. Baldwin, Council Bluffs, Iowa. Capital stock, $1,000,000.

PASADENA, CAL.—The Mount Lowe Railway Company has been organized to construct, lease and operate electric and other railways; operate telephone and telegraph lines, water, electric lighting and power plants. The promoters are Thaddeus S. C. Lowe, Leon P. Lowe, Herbert C. Brown, Sobieski Lowe, Pasadena, Cal.; Thaddeus Lowe, Altadena, Cal. Capital stock, $1,000,000.

PASADENA, CAL.—The Pasadena & Altadena Railway Company has been incorporated to construct and operate a railway to be operated by electricity or stationary or locomotive gas or steam engines or wire cables. Those interested in the project are Leon P. Lowe, Thaddeus S. C. Lowe, L. A. Lowe and Herbert C. Brown, Pasadena, Cal., and Thaddeus Lowe, Altadena, Cal. Capital stock, $100,000.

AUBURN, N. Y.—The Osborn Electromagnetic Railway System has been incorporated in West Virginia for the purpose of manufacturing apparatus and all kinds of appliances pertaining to electric railway equipment. The promoters are Byron E. Osborn, J. Harrison Pearson, Ruth E. Osborn and A. J. Parker, Auburn, N. Y., and Charles Thompson, New York City. Capital stock, minimum $30,000, maximum $1,000,000.

NEWS OF THE WEEK.

MONTREAL, CAN.—The Street Railway & Abbatoir Company proposes to build a new street car line.

RICHMOND, VA.—The work of breaking ground for the line of the Traction Company has been commenced.

ST. PAUL, MINN.—It is rumored that the Shelby Avenue Railway Company will equip its line with electricity.

NEW HAVEN, CONN.—The New Haven Street Railway Company proposes to extend its Lake Whitney branch to Centreville.

PITTSFORD, VT.—A movement is on foot for the building of an electric railway between Pittsford depot and Pittsford mills.

WOONSOCKET, R. I.—The Woonsocket Street Railway Company will commence on the Blackstone extension of the electric street railway system at once.

JERSEY CITY, N. J.—The Newton Traction Company has perfected its organization and will build and maintain electric railways, electric light plants, etc.

PORTSMOUTH, VA.—General Siegfried is expected in Portsmouth to have a hearing before the Street Committee with reference to his proposed electric road.

BANGOR, ME.—The petition for a double track on Main Street was granted the electric railway by the City Government, and work thereon will be begun at once.

MILWAUKEE, WIS.—The Railway Committee of the Common Council has finally voted to report in favor of granting a franchise to the McGann Street Railway.

DENVER, COL.—The Western Electric Transit & Power Company will build and operate electric lines and furnish power in Arapahoe, Jefferson and Grant Counties.

POTTSVILLE, PA.—The citizens of Shaefferstown and vicinity have subscribed nearly $45,000 for the extension of the Reading & Womelsdorf Electric Railway to that place.

GREENBURG, PA.—Judge Sadler of Carlisle is at the head of a company of capitalists which is building an electric road from Greensburg to Wilmerding, a distance of 20 miles.

BLOOMFIELD, N. J.—The question of building a trolley system from the Bellevue Avenue station in Bloomfield to the Arlington Avenue station in East Orange is again being agitated.

ST. LOUIS, MO.—It is stated that Charles Green, president of the People's Railway, will change the cable system of that line to an underground electric conduit system, within the next year.

UNIONVILLE, PA.—The citizens of Unionville are desirous of having an electric railway to connect this place with West Chester, and about $20,000 has been subscribed toward building such a road.

NORWALK, CONN.—A preliminary survey has been made over the route of the proposed trolley line between Norwalk and New Canaan, which will be built by the Tramway Company of this place.

MANCHAUG, MASS.—The proposed electric road from East Douglas Station, via Manchaug and Sutton Center, to Millbury, is again being talked of. Hon. James W. Stockwell is one of the projectors.

CLEVELAND, O.—Tom Johnson, of Cleveland, and other capitalists have organized a company with the intention of building a new street railway system in Buffalo. Six miles of track will be put down.

LAUREL, MD.—A number of surveyors employed by the Maryland & Cumberland Electric Street Railway Company are in Laurel, with the purpose, it is understood, of surveying a new route for the electric road.

FOND DU LAC, WIS.—Elihu Colman has closed a deal whereby the entire property of the Fond Du Lac Light, Power & Railway Company has been transferred to other parties, supposed to be Milwaukee capitalists.

CALDWELL, N. J.—The Borough Council last week gave the citizens a public hearing on the application of the North Jersey Traction Company for a franchise, and the meeting authorized the Council to grant the franchise.

NEW PHILADELPHIA, O.—The Commissioners of Tuscarawas County awarded the franchise for the building of an electric railway between this city and Uhrichsville to Major Charles E. Mitchener, of New Philadelphia.

MANKATO, MINN.—C. L. Alleman and S. R. Snow will, at the next meeting of the Council, ask a franchise for a combined electric street railway, electric light and steam-heating plant, to be built and operated as soon as possible.

CHICAGO, ILL.—The business men in the southern and northwestern sections of the city are anxious that the West Chicago Street Railway should extend its Ashland Avenue line to Twenty-third Street, and this will probably be done.

WASHINGTON, D. C.—The power house for the operation of the F Street electric line will be located on Fourteenth and East Capitol Streets, N. E. The officials of the company have purchased a site and the work will be commenced soon.

WATERFORD, CONN.—The directors of the local Street Railway Company, E. P. Shaw, Jr., and the village selectmen, have gone over the Waterford property to consider a route for the contemplated electric road between Waterford and New London.

GEORGETOWN, D. C.—Work will be commenced by the Georgetown Barge, Dock, Elevator & Railway Company on the double track line through Water Street from Aqueduct Bridge to Rock Creek, the necessary permission having been obtained.

DOYLESTOWN, PA.—The application for a charter for the Delaware & Schuylkill Traction Company has been filed in the Recorder's office. Francis Fennimore, Wm. Jenks Fell, Marshall S. Lynch, Robert C. Fulton and Samuel A. Hamilton are the applicants.

RICHFIELD SPRINGS, N. Y.—A charter election of the village of Richfield Springs was held Oct. 8 to determine the fate of the Little Falls & Richfield Springs electric road. John Guyer was elected vice-president. A new application will be made for a franchise.

CAMBRIDGE, PA.—Work is about to be commenced on the electric railway between Cambridge and Edinboro, and it is stated that the line will be extended to Meadville by way of Venango and Saegertown. The road will be 10 miles long, and the estimated cost is $120,000.

SPRINGFIELD, O.—The County Commissioners have granted a franchise to the recently incorporated Dayton, Springfield & Urbana Railway Company, of which John G. Webb is the active local representative, to construct an electric line over the National & Valley turnpikes.

CHESTER, PA.—Surveyors are locating the line for the proposed extension of the Prospect Street Railway, on the north side of the P. W. & B. Railway. The trolley road will eventually extend through Morton and Rutledge, to the Baltimore Pike, thus connecting with the Delaware County & Philadelphia line.

SKANEATELES, N. Y.—The village trustees have granted to the Auburn Inter-Urban Railway Company a franchise to build and operate an electric surface railway in this village commencing at Fuller Street in the west bounds of the corporation and running along Fulton and Genesee Streets easterly to Jordan Street.

BENTON HARBOR, MICH.—A company has been organized for the purpose of building an electric line from the City Hall on Main Street, to Eastman Springs, a distance of about two miles, and the City Council will be asked for a franchise at its next regular meeting. It is estimated that about $60,000 will be spent on the road.

PORT HURON, MICH.—The Lapeer Avenue Street Car Line was formally opened last Frida ynight. The stockholders and board of directors, together with the Common Council and Mayor Boynton, made the trip over the line in a special car, after which a banquet was served at the Union. The new line is one of the best equipped in the State.

NEW HAVEN, CONN.—The Winchester Avenue Street Railway Company, which controls a number of important lines in and about this city, has voluntarily increased the wages of 140 of its motormen and conductors. The increase ranges from 2½ to 5 cents an hour, according to the length of time the men have been in the employ of the company.

MONTREAL, QUE.—Applications have been made to the Dominion Parliament for an act to incorporate a company to build another Hudson Bay Railway. The proposed road is to be worked by either steam or electricity, and is to run from Winnipeg, Man., to Saskatchewan, at or near Grand Rapids, and thence to deep water navigation in Hudson Bay.

READING, PA.—Under instructions from the department at Washington, Postmaster Thompson has made final arrangements for carrying the mails from this city by electric cars to Adamstown, a distance of 13 miles. The mails will be carried in a specially equipped car, and the crews have been sworn in. If this experiment proves a success the service will be extended.

HOBOKEN, N. J.—The Common Council has granted a franchise to the Hoboken Railway, Warehouse & Steamship Connecting Company to operate an electric freight railway within the limits of the city. The object of the company is to run a freight line on upper Hudson Street and along the river front, so as to give direct communication between the various steamship lines, the warehouses along the river front, and the principal railways.

CHICAGO, ILL.—Negotiations have been closed which have placed the Englewood & Chicago Electric Railway Company and the Chicago & Morgan Park Street Railway Company in the hands of a wealthy syndicate of Eastern capitalists. The deal, it is said, contemplates the ultimate consolidation of the various electric railway systems which form a network of lines from Sixty-third Street to the Indiana line, and from the lake to Morgan Park. Overtures have been made to the owners of the Calumet Electric Street Railway, which now operates fifty-four miles of road.

CHICAGO, ILL.—The Chicago City Railway Company is making efforts to extend its lines to that portion of Hyde Park which is without railway facilities. The Forty-seventh Street line is to be extended eastward from Cottage Grove Avenue to the lake, and the company also hopes to secure consent for a north and south line on some one of the thoroughfares between Forty-seventh and Fifty-fifth Streets. The plans submitted to the Hyde Park property owners by the City Railway Company are for an ornamental trolley structure, with the finest cars ever placed on a street railway in Chicago.

CHICAGO, ILL.—The announcement is made that the Chicago City Railway Company has secured a majority of frontage for its proposed trolley line in Clark Street, between Washington and Adams Streets. The council passed an ordinance a few months ago giving the right to the railway company to run a trolley in Clark Street as far north as Washington Street. Some opposition developed against this, and the measure was amended, the northern terminus of the trolley being made Adams Street. Subsequently, however, another ordinance was introduced giving the right of way between Washington and Adams Streets. Trolley poles are now erected in the street as far north as Adams Street, though the ordinance has not yet been passed.

CHICAGO, ILL.—The Indiana Street line was changed last week from horse to electric power. Cars on that line now run in Lake Street from State Street to Halsted, thence north on Halsted to Grand Avenue and thence west over the old route to the end of the line. In Lake Street the trolley wire is strung under the elevated structure, and it is expected that electricity will be applied as a motive power along the entire length of that line in a few days. It is the expectation of the Lake Street Elevated Company to change that system from steam to electricity as a motive power within three months, and when this is accomplished all street-car traffic on the west side, with the exception of Madison and Halsted Streets and Blue Island Avenue, will be operated electrically.

ATLANTIC CITY, N. J.—The Camden & Atlantic Railway Company's proceeding against the City Council has incensed that body. Last week the Council passed to its third reading an ordinance repealing the ordinances giving the company the right to operate its line on Atlantic Avenue. An ordinance was then introduced granting the Atlantic City Southern Railway Company the right to locate, build, and operate a line of street railway on Atlantic Avenue and on several cross avenues. The new company agrees, in consideration of the right, to pave Atlantic Avenue from curb to curb, and to pay the city a license for each car. The repeal ordinance will be put on its final passage at the next meeting of Council. The new company is backed by Philadelphia capitalists.

TRADE NOTES.

THE J. G. BRILL COMPANY, of Philadelphia, manufacturers of street railway cars and trucks, received an order this week from the Brooklyn Heights Railway Company, Brooklyn, N. Y., for eight Brill No. "21 C" trucks. This is only one of a number of such orders.

W. D. FORBES & CO., 1500 Hudson Street, Hoboken, N. J., are distributing a very neat catalogue of engines, milling machines, lathe chucks, etc., manufactured by them. Messrs. Forbes & Co. are building a very compact, high-speed, automatic engine of their own design for electric service, in sizes from 40 to 100 hp, and also making a full line of lathe chucks, in universal, independent and combination forms, which are known as the "National," and are handled by Wm. Whitlock, 39 Cortlandt Street, New York.

THE NEWBURGH ICE MACHINE & ENGINE COMPANY, Newburgh, N. Y., has bought out the Whitehill Engine & Pictet Ice Machine Company, and will continue the manufacture of high-grade Corliss engines for electric light and other service, under the supervision of Mr. Robert Whitehill, the designer, who is secretary of the new concern. Mr. Whitehill has had long experience in engine building, having been formerly associated with the E. P. Allis Company, and latterly the head of the company, which is succeeded by the present corporation. Mr. Edgar Penny, the president of the new company, is also an old engineer; he earned a high reputation as superintendent and designer for George H. Corliss, and for the past twelve years has been mechanical engineer and general superintendent for the Frick Company. Under two such experienced and capable men as Messrs. Penny and Whitehill there can be no doubt as to the quality of work the new company will produce.

THE AMERICAN DISTRICT STEAM COMPANY, of Lockport, N. Y., is distributing copies of an exceedingly interesting catalogue describing the Holly system of direct and exhaust steam heating, one of the many ingenious features of which is a device designated as a "service variator," whose function is to take care of the expansion and contraction of the underground piping; in other words, an improved form of expansion joint. The catalogue contains some convincing arguments in support of the sale by electric light and power stations of their exhaust steam for heating buildings of all kinds. The Holly system has been worked out in all its details with the greatest care and engineering skill, and has been brought thoroughly up to date in every respect, so that it would be difficult to imagine conditions to which this admirable system is not adapted. The necessary apparatus has also received full attention, and there are provided steam traps, cooling coils, pressure regulators, steam meters, etc., of the most approved type.

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED OCTOBER 29, 1895.

546,627. ELECTRIC TRACTION; Emile Chabeault, Marseilles, France. Filed Aug. 17, 1894. The patent relates to the combination in an electric railway of current furnishers, including contacts, the bell-shaped cover, a perforated rod, a piston, and a cylinder in which the piston moves.

548,631. CAR FENDER; John H. Doerr, Camden, N. J., assignor of two-thirds to Jacob Lodge and Hanford C. Smith, Philadelphia, Pa. Filed Aug. 5, 1895. A pneumatic roller is supported in bearings and has its surface furnished with conical or pyramidal projections. The roller has annular grooves which bear against and revolve with the flange of the car wheel for the purpose of rotating the roller.

548,634. TRACK CLEANER; Charles T. Fisher, Baltimore, Md. Filed May 31, 1895. The scraper plate is adapted to clean the track rail, and ears are adapted to engage the holder of it so as to prevent the escape of the scraper plate. The plate has a hole between its end, and a pin is adapted to fasten through and rest on the holder to sustain the plane in an elevated position.

548,648. CAR BRAKE; James P. Martin, Montreal, Canada, assignor of two thirds to Enoch James and Frank Gormley, same place. Filed Nov. 14, 1894. One or more levers are fulcrumed adjacent to the car wheel and have outer ends which are adapted to be pressed upon the thread thereof. A movable wedge block in the form of a truncated cone is mounted to slide on the axle and is adapted to operate the levers by bearing upon the inner ends thereof, means being provided for preventing the rotation of the block with the axle. A worm which is rigidly carried by the axle with an engaging device in the form of a pivoted finger, with springs for keeping it normally in a disengaged position, is carried by the wedge block for effecting an engagement between the block and the worm. Mechanism is provided for returning the block to its normal position and there is a suitable flexible connection under the control of the motorman for bearing upon and moving the engaging device into mesh with the worm.

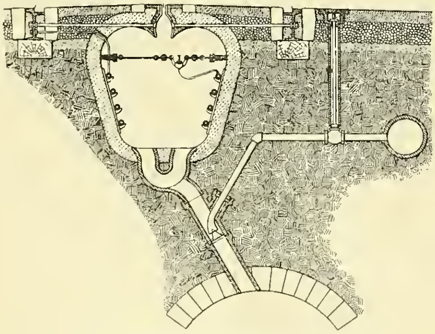
548,663. RAILWAY TRACK; Samuel R. Scharf, Washington, D. C. Filed Aug. 3, 1895. This is a combined header and stretcher, comprising a base or bearing plate and an upright plate, and provided with one or more lugs adapted to bear against the web of the rail, but to clear its tread and base.

548,704. TROLLEY WHEEL; Ferdinand J. Feldt, Peoria, Ill., assignor of one half to Arthur Hoklas, same place. Filed April 20, 1895. The body of the wheel has an oil recess formed in each side thereof, and the hub has an oil channel passing along its bore and communicating with the oil receptacle. A wick lies in the channel, and plates or caps close the oil receptacles.

548,786. UNDERGROUND ELECTRIC RAILWAY; Henry B. Nichols and Frederick H. Lincoln, Philadelphia, Pa. Filed March 11, 1895. The conduit is slotted and has a conductor located therein which is out of alignment with the slot. A drain is located in the base of the structure and is substantially in alignment with the slot. From the drain a pipe leads to a culvert or other discharge and is adapted to collect and receive moisture that accumulates in the conduit. A steam or water spray pipe is located in the pipe and is adapted to induce suction to assist in the discharge from the drain to the culvert. (See Illustration.)

548,805. GUARD FOR STREET CARS; Henry A. Howe, Newark, N. J., assignor to Charles S. Stockton, same place, and Joseph Livingston, New York, N. Y. Filed Aug. 8, 1895. The guard has a round bar at the upper and back ends and hooks are connected with the platform and receiving removably the cross bar of the guard. A spring is supported on one of the hooks and an arm on the cross bar of the guard acts upon the spring.

548,815. CAR FENDER; James O'Donnell, San Francisco, Cal. Filed July 8, 1895. The fender consists of a shield, the normal tendency of which is to fold around an obstructing body, and has horizontally spaced fingers at its ends adapted to pass between each other when the shield is folded. Means are provided for holding the shield in an expanded or open position ready for use and for tripping the holding device so that it may fold upon an obstructing body.

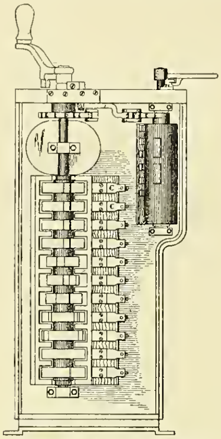


548,786.—UNDERGROUND ELECTRIC RAILWAY.

548,906. CAR FENDER; Henry Brandt, Brooklyn, N. Y. Filed April 25, 1895. The fender comprises a horizontal portion projecting from the front of the car and a step-shaped portion pivoted thereto, springs arranged to automatically elevate the step-shaped portion, means for retracting and holding the springs from operation and a frame arranged to pass over and beyond the fender.

548,939. BRAKE SHOE; William W. Whitcomb, Brookline, assignor to the Composite Brake Shoe Company, Boston, Mass. Filed Feb. 1, 1895. The brake shoe has its contacting face provided with a plurality of substantially parallel slits or channels located side by side longitudinally.

548,952. ELECTRIC BRAKE; Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed June 29, 1894. The patent covers means for controlling the current flow in the circuit of an electric braking apparatus supplied from a series motor or motors operated as generators by the momentum of a moving car, and relates to means for controlling the excitation of the motor or motors, thus regulating the amount of current supplied to the circuit. (See Illustration.)



548,952.—ELECTRIC BRAKE.

548,967. CAR FENDER. Samuel A. Darrach, Newark, N. J., assignor to the Darrach Car Fender Company, same place. Filed Feb. 7, 1895. The fender is made to extend upward in front of the platform above the level thereof. A drop guard is pivoted back of the front or free edge of the platform and is made to project forward from the pivot. A trip for the guard is provided, the fender being mounted, however, independently of the trip and the guard.

548,974. CAR FENDER. George L. Favorite, Washington, D. C. Filed May 28, 1895. A tilting extension is pivoted to the front end of the fender and forms a continuation thereof. Notched brackets are secured to the fender and rods having cross pieces or lugs at their rear ends engage the brackets and links or segments are connected to the rods and to the extension.

548,976. CLOSED CONDUIT ELECTRIC RAILWAY; Michael F. Flynn, Stamford, Conn. Filed Nov. 27, 1894. The system comprises a conduit having supply and return wires therein, a contact rail, on which a trolley mounted on the car is arranged to run, switch devices at intervals in the conduit adapted to connect with the supply and return wires and mechanism carried by the car for operating the switch devices.

548,997. ELECTRIC MOTOR CAR TROLLEY; James M. Kennedy, Hollidaysburg, Pa., assignor of three fourths to Thomas F. Johnston, same place, and William F. Gable and Galen Hemperly, Altoona, Pa. Filed May 31, 1895. A turn-table is held on top of the car and the trolley arm is carried thereon. A lantern is held on the table to throw the rays on the trolley and wire and a lever mechanism is operated from within the car and is connected with the turn-table.

549,068. CAR FENDER; John Kerrigan, Philadelphia, Pa. Filed Aug. 2, 1895. The fender has jointed side bars, a buffer connected with the front ends of these bars and transverse and longitudinal chains having intermediate connection. The tranverse chains each have direct connection with the side bars and the longitudinal chains are secured to a rod adjacent to the buffer.

549,084. RAILWAY RAIL JOINT; John F. Whitaker, Crystal, assignor of one half to William E. Mugford, Muskegon, Mich. Filed Feb. 23, 1895. The rail coupling has at one end a projecting tenon with a shoulder on the under side thereof. The outer end of tenon is inclined at an angle of 60 degrees, and also two triangular-shaped projections. The end adjoining the rail is provided with a groove having a slot and two recesses to receive the projections when coupled together.

549,091. TROLLEY FOR ELECTRIC RAILWAYS; Jacob Hess, Scranton, Pa. Filed May 13, 1895. A pair of discs is rotatable on axes parallel to the plane of rotation of the main trolley wheel, closing together above and in the centre plane of the main wheel. The discs are adapted to be held in a closed position by guides which run concurrently with the trolley wire at switches, but are adapted to be pressed apart by the wedge-shaped edges of the supports of the trolley wire. They may be fully opened and released from the trolley wire by means of levers or arms.

Electric Railway Gazette.

Vol. XIII. NEW YORK, NOVEMBER 16, 1895. No. 20.

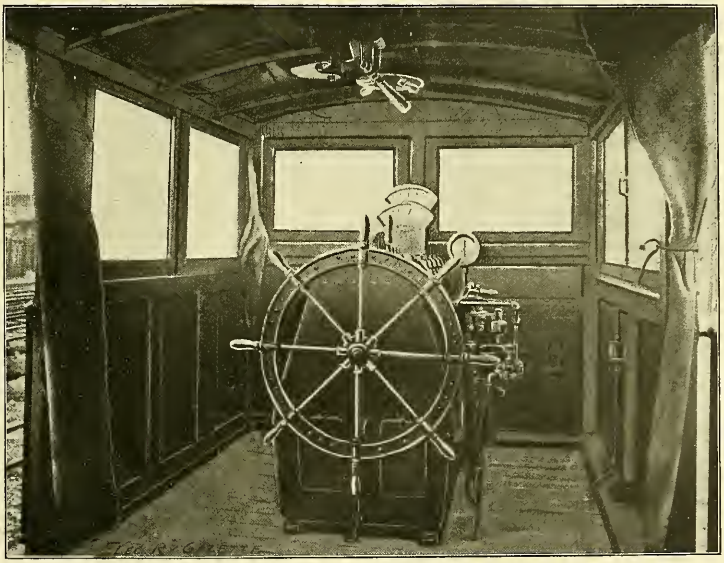
A Trip on the Baltimore Electric Locomotive.

To appreciate at their proper value the points of interest of the Baltimore tunnel electric installation, a personal investigation is necessary. The plant in many respects is unique, and in operation the new system has proved successful in a marked degree. The electric locomotive and the equipment have been repeatedly described at great length, but there are still novel features in the installation that have not been noted.

It has been stated in previous descriptions that the power station contains four units, which are well worthy of special note. The massive drum-wound armatures, of the barrel type, are overhung The weight of each one of them is not less than 23 tons, and the centre of gravity is fully two feet from the end of the bearing. The bearing which sustains this enormous strain is 16 inches in diameter and 30 inches long, and has caused no trouble whatever. When it is realized that only a slight clearance is allowed, and that a still less displacement of the core from the axis of symmetry would throw the armature out of magnetic balance, the result must be conceded to be an engineering triumph.

It is interesting to watch the switchboard ammeters, for by the movement of the needles one can tell what the locomotive is doing and even the direction it is taking. It will be remembered that the electric locomotive at present only hauls the heavy freight trains up the grade through the tunnel. Hence a heavy current indicates that the locomotive is going away from the station drawing a train, while a light current indicates its return.

The locomotive has always attracted the greatest attention, and it is worthy of all the interest that has been manifested in it. When seeing it the first time one is struck by its great height, overtopping as it does the massive compound "Director General." A man of average height finds it a difficult matter while standing on the ground to place a pebble on the floor of the cab.



INTERIOR OF CAB.

The weight of this enormous locomotive has recently been increased by nearly one ton of additional starting resistance. Weight, however, is an advantage rather than the reverse. Ascending into the cab, the visitor at once notices the roomy accommodations. The controller occupies the front end of the cab, with liberal space on each side, as is shown by the cut. The rear of the locomotive contains the little oscillatory air-pumps, but even then there is ample room for two large tool chests, and if it were desired, there could be placed in the cab a table at which six or eight persons could sit. The locomotive is broken at the cab doorways, and is flexibly connected so that it may round the difficult curves at the entrances of the tunnels. A heavy automatic circuit-breaker is placed in the forward part of the cab. A hand circuit-breaker is provided overhead within easy reach of the engineer. The value of this device is evident to any one manipulating the controller. As the latter is necessarily very large, and as very heavy currents are to be transmitted, the contacts must be the best possible and must be firm and unyielding. Therefore considerable power must be applied to the wheel, and this involves no trouble when slowly turning on the current, but in case a sudden stop is necessary throwing the overhead breaker would be much more expeditious than turning the wheel. An indicator shows the three positions, off, series, and multiple. An ordinary standard air-brake controlling valve is at the right of the controller. The controller wheel has painted spokes to indicate the various positions; one blue and one red spoke are diametrically opposite. A foot-catch locks the wheel when not in use and clicks into notches on the inner surface of the latter.

On the top of the controller is a voltmeter, and just in the rear and a little above is an ammeter. Both these instruments are of the Weston illuminated-dial type. The ammeter has a capacity of 5000 amperes. It is needless to say that the indications of this instrument are very interesting during the operation of the locomotive, The air-pump works automatically. After a loss of pressure, either from whistling or operating the brake, the little motor starts up and pumps the pressure up to 80 pounds, when its circuit is broken and it stops, ready for the next drop of pressure that may occur. The entire motor is flexibly supported on rubber cushions. It is series-wound and appears to operate sparklessly at all speeds. The cab is lighted by six lights, which are controlled by a switch.

The trolley shoe is a massive, shuttle-shaped, brass casting. As is known, the trolley groove consists of two Z-bars placed side by side. During the first trips of the locomotive the rough Z-bars caused a brilliant sparking, which gave rise to considerable adverse criticism from the public, who were ignorant of the conditions. When the contact surfaces became smoothed there was absolutely no trouble from this cause. The sparking is now as light as that attending the operation of ordinary trolley cars.

The writer had the good fortune to be on the locomotive when it was pulling an exceptionally heavy train through the tunnel. There is a slight down-grade on the approach and the electric locomotive took a position just inside the tunnel, and the train, drawn by a 107-ton freight locomotive and pushed by a second engine, was allowed to drift down upon the electric locomotive and was coupled thereto. Then came one of the most interesting parts of the whole trip, the starting. Up to this time the current used to operate the locomotive had hardly been sufficient to move the ammeter needle, but when the controller was turned two notches the current rose to 100 amperes and the draw-bar creaked; 150, and the train slowly began to move. It was a critical time, for excessive pulling would have snapped the coupling-pin or broken the draw-head. It was a splendid illustration of the principle that it takes time to set a mass in motion. Notch by notch the controller was advanced, and presently the indicator denoted full series, and at that position, half speed, the heavy train was rapidly drawn along, the ammeter indicating 1200 amperes. In the darkness of the tunnel the behavior of the trolley could be easily noticed; save when it struck a wet spot the sparking was negligible.

It will be remembered that at present passenger trains are not pulled through by the electric locomotive, but are drawn by their own engines. One of these had just preceded the electric locomotive and the smoke was stifling, the incandescent lamps in the tunnel appearing a lurid red, though they were fully up to candle-power. When the freight trains also puffed through the tunnel the engineer and fireman were not infrequently compelled to get out on the ground in order to breathe.

Approaching the exit of the tunnel the grade became steeper, as indicated both by a slight slowing in speed and a rise in current to 1500 amperes. Having drawn the train out as far as the trolley construction would allow, the electric locomotive was uncoupled and ran onto a siding. It was quite amusing to see the 107-ton steam locomotive then struggle with the load that the 97-ton electric had pulled so easily. The harsh, sharp exhaust and the wheels slowly turning indicated great effort. At the same time its consort in the rear was working equally hard.

The overhead construction for the electric locomotive is broken just beyond the mouth of the tunnel. A new bridge necessitates this break, but when the line is clear the electric locomotive can travel several miles farther and will be able to haul the long trains entirely out of the tunnel and up the heavy grade beyond. A new passenger station is being built at this end of the tunnel, and when this structure is completed, and electric locomotive No. 2 is in service, the tunnel traffic will be wholly electric.

The new electric locomotive that is expected in a few months will embody several radical changes from the plans of that now in operation. The controller, instead of having a wheel like that of No. 1, will be provided with the more familiar throttle handle. The engineer of No. 1, an old steam engineer, says that he now prefers the hand-wheel to the throttle.

E. M. Traction System.

Electric railway systems of the class to which the E. M. traction system belongs are always interesting because great ingenuity is required to make them operative. When such a system gives promise of commercial success it is worthy of special consideration. The E. M. traction system, which was invented by Mr. James F. McLaughlin, of Philadelphia, has attracted sufficient attention so that an abundance of capital has been available to give it a thorough trial. The method which the inventor has adopted may be briefly described as follows: Between the track rails a third rail is laid which is divided into insulated sections. As the car passes over these sections they are successively connected electrically to the positive terminal of the dynamo, and the current thus finds its way into the motors, returning through the rails to the station. The conducting section is cut out before the car has completely passed over it.

The plan of the system is reduced to an elementary diagram in Fig. 1. The negative terminal of the dynamo is attached to the rails, while the positive feeder is present in each of the contact boxes, *b*, *b*, and by a suitable mechanism is connected and disconnected to the section of the third rail, *R*, *R*, at the proper intervals. The general appearance of the track construction is shown in Fig. 2.

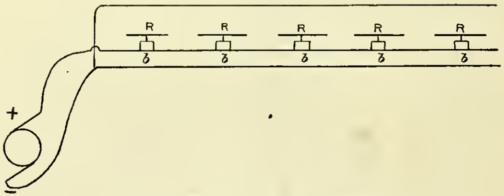


FIG. 1.—PLAN OF E. M. SYSTEM.

The contact box is placed on one side of the third rail, and the feeder is located on the other side. The tap from the feeder penetrates the wooden beam on which the third rail rests and enters the contact box. Emerging therefrom it returns to the wooden support, and enters the rail itself by means of suitable castings which are screw-fitted. These castings may be seen at the left in Fig. 5, leaning against the block that supports them. Their position represents the way in which they penetrate the supporting beam of the third rail. The third-rail support is thoroughly treated with a preservative and moisture-repelling compound.

Fig. 2 shows the arrangement of a single box on the track. The contact boxes contain a switching device which is operated by powerful magnets carried by the car. The details of the device at present in use are shown in Fig. 5. A rectangular frame pivoted on its longer diameter carries two heavy iron armatures which are alternately attracted by the magnets on the car. On the car are two magnets, Fig. 9, one of which attracts the armature on the right and the other that on the left. The magnet which attracts the left-hand armature is on the front of the car, while that attracting the right-hand magnet is on the rear of the car. Thus the car in traveling over the box causes this frame to make one complete revolution and leaves it precisely as it found it. The attraction and consequent raising of the left-hand armature throw a switch arm mounted on the pivot of the frame and thereby close a contact, thus making the adjacent rail alive. This contact is situated in the base of the apparatus, and is shown in the view of Fig. 6. This contact is effected when the left armature is raised and is broken by a double break when the right-hand armature acts. An ingenious detail of the device is the arrangement for locking the contact in the off position when the car has passed. This is effected by the latch shown immediately under the armature, Fig. 5. The latch is rigidly fastened to a thin plate of iron at right angles thereto and is pivoted on the edge of the armature proper at the point of this angle. The action of the attracting magnet is simply to lift this plate and thus move the latch to the right, thereby releasing the frame which, when tilted, closes the switch. When tilted back by the rear magnet the latch locks by gravity.

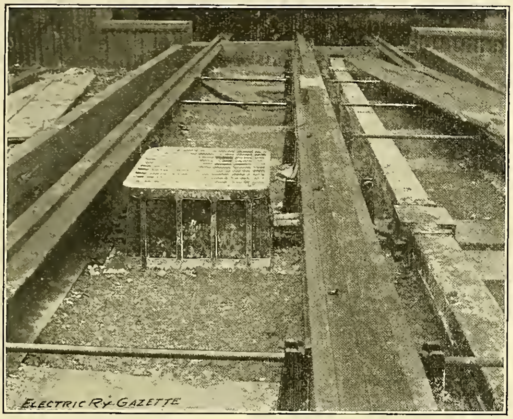


FIG. 2.—TRACK CONSTRUCTION.

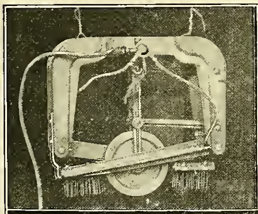


FIG. 3—CONTACT PLOW.

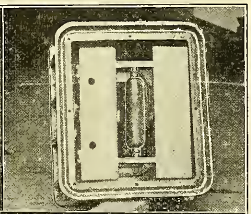


FIG. 4.—CONTACT BOX OPEN.

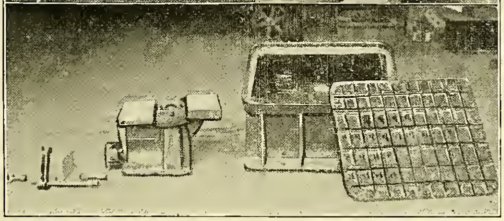


FIG. 5.—DETAILS OF CONTACT BOX.

Recently it has been proposed to use the double latch shown in Fig. 7. This arrangement merely involves the use of the latching device on both armatures, and it firmly locks the contact in both positions.

Nothing but a magnet can operate the device from the outside. It may be asked: How can the magnet be operative through the heavy cover? This difficulty has been ingeniously met by the use of a special alloy. The ribbed cover contains 60 per cent. of iron, and yet its magnetic continuity seems to be thoroughly broken by means of the other components, and the leakage through it is trifling. These boxes are sealed with an asphaltic compound and are entirely water tight. In addition, the hollow pedestal of the contact device, which contains the contact, is thoroughly sealed at its base in the interior of the box. Thus, in order to reach the contact, moisture must penetrate two most carefully made joints. Fig. 4 shows the appearance of the moving parts in their enclosure.

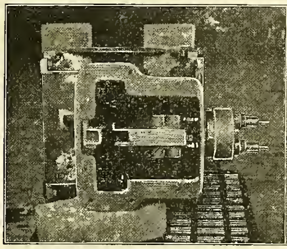


FIG. 6.—SWITCH CONTACT.

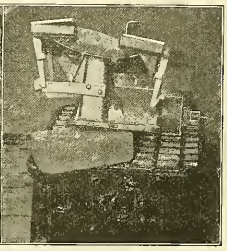


FIG. 7.—PROPOSED DOUBLE LATCH.

The experimental track is U-shaped, and contains an extremely sharp curve. It has been fenced in, so that it might be flooded with water, and at the same time other severe tests have been made, all of which the inventor states the system has successfully withstood.

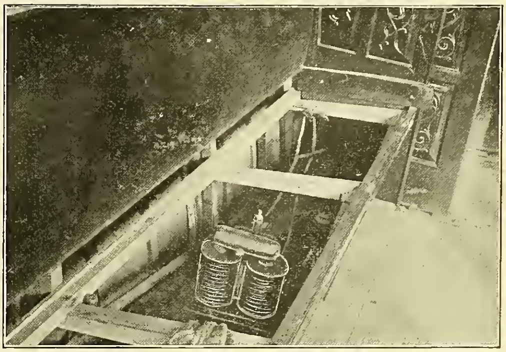


FIG. 8.—BATTERY CUT-OUT.

The contact rail is an ordinary T-rail, with the top planed, but when long lines are installed a special rail will be rolled for this purpose. It is secured to its stringer by large screws through holes punched in the lower flange. The track itself is of standard construction and a 9-inch Johnson rail is used. In practice the contact rails will be set in asphalt, and thereby insulated to a great extent from the car rails.

The contact boxes, as already stated, are operated by powerful magnets carried by the car. They are of the horseshoe type, and in Fig. 9 are shown stripped of their protective fender, which is designed to brush away all foreign matter. The magnets carry two coils, equal in magnetizing power, although the outer coil is wound for 500 volts, while the inner coil is wound for 12 volts. The latter coil serves as a reserve, and automatically comes into play should anything happen to the outer high-voltage coil.

The low-voltage coil is operated by storage batteries carried on the car. Fig. 8 shows the automatic cut-out which operates the storage batteries. The storage batteries are necessary to furnish an initial starting current if for any cause the current from the generator should fail, as in the case of a circuit-breaker dropping.

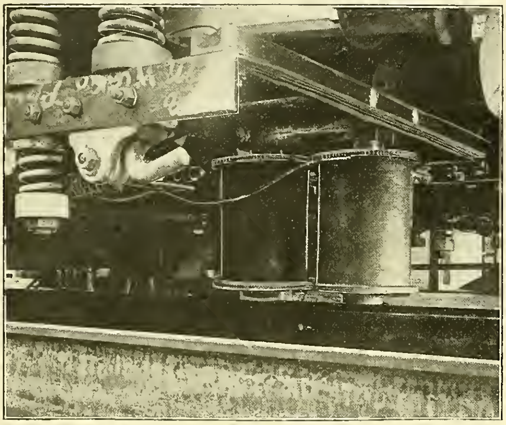


FIG. 9.—OPERATING MAGNET.

The system also provides for several alarms to indicate faults in any of the various devices. This entire apparatus, as well as the batteries, is located under the car seats.

The current-collecting device is shown in Fig. 3. It is a heavy brass wheel with two steel-scraping brushes, one in front and the other behind. The latter not only scrape the rail, but make an electrical contact of their own. With a clean rail in normal condition this trolley is said to work sparklessly and smoothly.

In developing the system Mr. McLaughlin has kept his eye sharply on its ultimate commercial utility. To this end he has purchased for use in his experiments only standard apparatus, and has so arranged his devices that they are only additions, the use of which necessitate no changes from existing arrangements.

If the system is adapted to an overhead trolley line it will be necessary to discard only the trolley and the overhead construction which in almost every case will be the feature, the desire to remove which would probably be the reason for substituting a new system. If required, however, a car may be equipped for both the E. M. and the ordinary overhead systems, as they will in nowise interfere with each other.

Overhead Feeder and Trolley Construction of the New Orleans Traction Company.

BY W. NELSON SMITH, M.E.

The New Orleans Traction Company has now practically completed the work of equipping its lines with electrical motive power, having been so engaged for the past 18 months. Its system comprises the lines of both the New Orleans City & Lake Railway and the Crescent City Railway, with the addition of several newer franchises owned by those corporations. The entire mileage of the system, including that of the car barns, is 114.05. All of this, with the exception of the Metairie Road line, has been rebuilt and electrically equipped. The following table shows the mileage of the respective lines :

DESIGNATION ON MAP.	LINES N. O. C. & L. R. R.	MILEAGE.
A	Prytania	9.23
B	Magazine	9.5
C	Esplanade	4.9
C	Esplanade & French Market (operated with Esplanade)	1.09
D	Rampart & Dauphine	6.21
E	Levee & Barracks	9.3
F	Canal St., Cemeteries & West End (7.33 miles electric)	13.33
G	Villere St	4.36
	Peters Ave. (operated as part of Judah Hart No. 2	1.18
H	Metairie Road	2.99
	Half joint tracks on Canal St	.66
	Car Barns	1.52
		64.27
	C. C. R. R.	
I	Tchoupitoulas	11.2
J	Annunciation	4.6
K	Coliseum	11.
L	Judah Hart No. 1 (Carondelet & Henry Clay Ave.)	13.04
M	Judah Hart No. 2 (Peters Ave. & Dryades St.)	7.97
N	Erato (operated with Annunciation)	.5
	Half joint tracks on Canal St.	.66
	Car Barns	.81
		49.78
	Grand total	114.05

Of this mileage at the present writing all is in regular operation electrically except the Metairie Road line, which is not likely to be rebuilt at present, and a portion of the Levee & Barracks line, now in process of reconstruction and nearly finished. When entirely in operation about 240 to 250 motor cars will be run regularly.

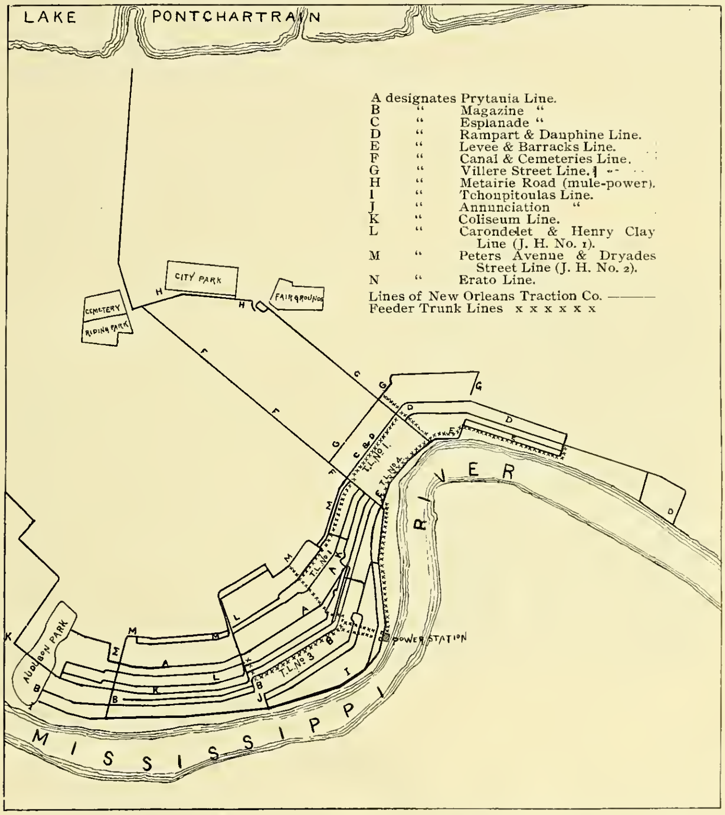
In view of the comparatively large size of this system, and the peculiar conditions prevailing, an account of some of the electrical engineering details may be of interest, particularly to those who are engaged in overhead line construction.

The accompanying map will convey a very good idea of the "lay" of the city and the territory served by the New Orleans Traction Company's system. The "West End" line is operated by steam dummies from the city to the Lake, and also electrically as far as the cemeteries; eventually it will probably be entirely electric.

The configuration of the city resembles the letter "S." As is well known, it is situated on very low, alluvial soil, the levee along the river bank having the highest elevation, the land thence gradually sloping back toward Lake Pontchartrain and the neighboring swamps. Some parts of the city are actually below the mean Gulf level, and have to be artificially drained. Water is to be found within a foot of the surface in almost any part of the city, at almost any time of the year.

Power is supplied to the Traction Company's lines from the station of the Louisiana Electric Light Company. This is situated on the river bank at Market Street, about a mile and a half above Canal Street (the principal business street of the city, where all the lines converge), and, although hardly at the geographical centre of distribution for the system, is not far from the most economical centre, as about two thirds of the cars are operated on the lines above Canal Street. This location necessitated the construction of several feeder trunk lines for conveying the current to the principal distributing centres of the various trolley lines.

The Canal & Cemeteries, the "Judah Hart No. 2" (Peters Avenue and Dryades Street) and the Prytania Street lines were the first to be electrically operated, and Trunk line No. 1 was laid out on what was considered to be the most feasible route for carrying the main overhead and ground return feeders to these lines. It runs up Market Street from the power station, thence on Felicity Street to Dryades, thence *via* Dryades Street to Canal, a total distance of 2½ miles. It terminates near the inner end of the Canal & Cemeteries line, and *en route* it crosses all the uptown lines, and sends out several branches for Prytania, "Judah Hart No. 1" and "Judah Hart No. 2." It also carries the Esplanade and Rampart & Dauphine feeder cables, which were originally intended to be run to the Esplanade Street distributing centre by a shorter route; but which for various urgent reasons were run by way of the longer route. In order to carry the feeders for these two last-named lines to Esplanade Street Trunk line No. 2 was built down to Burgundy Street, from Canal to Esplanade, about seven eighths of a mile, as a continuation of No. 1. The distributing centre of these two lines is at Esplanade and Burgundy Streets.


LAKE PONTCHARTRAIN
A designates Prytania Line.
B " Magazine "
C " Esplanade "
D " Rampart & Dauphine Line.
E " Levee & Barracks Line.
F " Canal & Cemeteries Line.
G " Villere Street Line.
H " Metairie Road (mule-power).
I " Tchoupitoulas Line.
J " Annunciation "
K " Coliseum Line.
L " Carondelet & Henry Clay Line (J. H. No. 1).
M " Peters Avenue & Dryades Street Line (J. H. No. 2).
N " Erato Line.
Lines of New Orleans Traction Co. ———
Feeder Trunk Lines x x x x x x
CITY PARK
CEMETERY
RIDING PARK
FAIR GROUNDS
C & D
T.L. No. 1
T.L. No. 4
T.L. No. 3
POWER STATION
AUDUBON PARK
RIVER
MISSISSIPPI

SYSTEM OF THE NEW ORLEANS TRACTION COMPANY SHOWING FEEDER TRUNK LINES.

For about a mile from the station Trunk Line No. 1 also carries two of the "Judah Hart No. 1" (Carondelet & Henry Clay Avenue) feeders, supplying the portion of that line lying below Louisiana Avenue. The "ground returns," or track feeders of the intersecting lines, are carried on this line, extending from the station to Franklin Street, about 7000 feet, at which point they are connected into the rails of the Peters Avenue line, which is treble-bonded from there to Canal Street. And at every street where the trunk line crosses a trolley line that forms part of the system a connection of No. 0000 wires or 500,000 circ. mils cable is made between rails and track feeders, running up the nearest pole.

It was originally intended to run all the feeder cables for the uptown lines on Trunk Line No. 1, but as the route turned one or two corners where the guying for so heavy a line, and with such soft soil, would have been exceedingly difficult and expensive—and never satisfactory—it was decided to build another trunk line, No. 3, from the plant up Richard Street (parallel and next below Market) to carry the feeders for the Annunciation, Magazine, Coliseum, and for that part of the Carondelet line above Louisiana Avenue. The main stem of this trunk line runs as far as Magazine Street; there it divides, a short branch running two blocks thence, to Camp and Orange Streets carrying overhead feeders for Coliseum and track feeders for Coliseum and Magazine lines, and the longer and principal branch, running up Magazine Street from Richard Street to Louisiana Avenue, carrying overhead feeders only, for the Magazine, Coliseum and Carondelet lines. The cables for the last-named line are carried out Louisiana Avenue to Coliseum Street, whence they diverge in smaller sizes to the feeding points, as do the other cables wherever they reach the principal distributing points of their respective lines.

The cables for the two remaining downtown lines, the Levee & Barracks and the Villere Street lines, are run on Trunk Line No. 4, which runs from the station down South Peters Street to Canal, then down North Peters Street to Esplanade, altogether about two and two fifths miles. Here the Villere cables diverge, running out Esplanade to Villere Street about 4200 feet. The Levee & Barracks feeders continue down North Peters Street, Lafayette Avenue and Chartres Street to their final distributing point at Poland Avenue and Dauphine Street, nearly 9000 feet farther. Trunk Lines Nos. 1 and 2 extend a distance of about three and one half miles; No. 3 about one and eight-tenths miles, and No. 4 about four miles, besides occasional shorter branches. The subfeeders carry the current along the trolley lines, from the distributing centres at their respective intersections with the trunk lines.

Having followed out the general scheme of distribution by the different trunk lines, we can now take up the various engineering details involved in their construction.

The very unstable condition of the soil renders the setting of heavy poles, or, in fact, any poles that are subjected to any considerable stresses, a matter of unusual difficulty. While digging holes, pumps have to be used almost constantly, and it is not unusual to be compelled to resort to "cribbing" a hole. "Common-sense" diggers are generally used instead of shovels. All the trunk-line poles are set eight feet in the ground and tamped in with concrete composed of broken bricks and Louisville cement—about one cartload of the former being used to the pole, and half a barrel of cement, the latter being grouted into the upper portion of the tamping. At corners, or where lateral stresses are greater than usual, double the amount of cement is used, and it is run in the tamping from top to bottom. The curbing of any sidewalk in town does not extend below the bottom of the gutter, and is frequently of brick or cypress plank; so that poles subjected to severe stresses that pull them against the curbing have to be anchored at the ground level by seven-eighths-inch rods and a tie plate to car wheels buried about six feet in the ground and set in concrete. This is only resorted to with corner or pull-off poles, careful tamping with brick being otherwise generally sufficient. Poles supporting the trolley span-wires are all provided with "heel boards" 3 inches x 12 inches x 3 feet pointed and driven down behind the butt of the pole before it is tamped. The sidewalk pavement, or "banquette," as it is called in New Orleans—generally consisting of paving brick cemented, or of artificial flag-stones composed of shells and Portland cement—usually helps materially in maintaining the proper rake of the pole after it is set, the poles being span-wired before the pavement is relaid.

Trunk Lines No. 1 and 2, and No. 3, as far as Louisiana Avenue, are built of 45-foot poles. Trunk Line No. 4 is of 35-foot poles from the station to Canal Street; thence to a short distance below Esplanade Street it is built of 45-foot poles, dropping to 35-footers again from there to Chartres Street, where it is carried on the standard 30-foot trolley poles for the rest of its length.

Difficult as it sometimes is to properly set them, the poles that can be procured in New Orleans are undoubtedly the handsomest in appearance and finest in uniform good quality of timber that can be had anywhere in the country. Those used in this construction are all of long leaf Southern pine, heart timber, sawed square, dressed and chamfered on the corners. The 30-foot poles for trolley construction are of the same class of timber, but smaller, having 7 x 7 inch tops and 11 x 11 inch butts; the 45-foot poles are 9 x 9 inches and 14 x 14 inches, as are also the 35-foot trunk-line poles and the 33-footers used as "pull-off" poles in the trolley construction. Before setting all poles have their butts painted over with "Carbolineum Avenarius," a well-known wood preservative, up to a short distance above the ground level, and the gains are likewise painted before cross-arming. Nearly all the poles were supplied by the Brakenbridge Lumber Company of New Orleans.

Iron poles are used for trolley construction on but three of the lines of this system, namely, Camp & Prytania, Esplanade, and for half a mile or more on Canal Street. Two varieties are ordinarily used, one being 4-inch, 5-inch and 6-inch sections, the other of 4½-inch and 6-inch. Pull-off poles at corners are of 5-inch, 6-inch and 7-inch pipe. Those along the "Neutral Ground" on Canal Street, which have to support three and four trolley wires, are of extra heavy pipe. The iron poles were chiefly supplied by the Electric Railway Equipment Company, of Cincinnati.

Obstacles to pole-setting are not altogether in the ground. Not only on the principal streets but all over town, galleries, sheds and wooden awnings project from the fronts of the buildings and the expense of cutting and repairing these overhead obstructions runs anywhere from 50 cents to $10 per pole, frequently more than the cost of setting the pole.

There are two standard sizes of cross-arms used in the feeder construction, six-pin arms, 3½ inches by 5 inches by 6 feet, being used on the heavy trunk lines, and four-pin arms, 3½ inches by 4¼ inches by 3 feet 8 inches, carrying the smaller sizes of wire in the sub-feeders; 1½ inch locust pins are employed throughout. For carrying the large cables "Columbia" top-groove glass insulators are the standard, the smaller wires being carried on ordinary "petticoat" glass. All cross-arms are double, with spacing blocks bolted between them, and they are braced with ¼-inch by 1¼-inch flat iron braces, 26 inches long for the six-pin and 20 inches for the four-pin arms.

(*To be continued.*)

Proposed Sale of the Long Island Traction.

The leases and franchises of the Long Island Traction Company of Brooklyn, are advertised for sale at auction, on Dec. 5, under a decree of the United States Court of the Eastern District of Virginia. The sale is to be made under the order of F. Kingsbury Curtis, special master appointed by the court. The Long Island Traction Company owns the Brooklyn Heights Railway Company, which in turn has a 999-year lease of all the lines of the Brooklyn City Railway Company. The sale is the result of a foreclosure suit brought against the Long Island Traction Company by the New York Guarantee & Indemnity Company. It is thought that those interested in the reorganization of the Long Island Traction Company will seek to enjoin the sale.

High Bid for a Franchise.

The Kingsbridge railway franchise, for which the Metropolitan and Third Avenue Companies, of New York, have been fighting for three years, has been sold at auction to the Third Avenue Railway Company. The price bid was 38½ per cent. of the gross receipts and $250-000 bonus in addition to the 3 per cent. for the first five years and 5 per cent. thereafter.

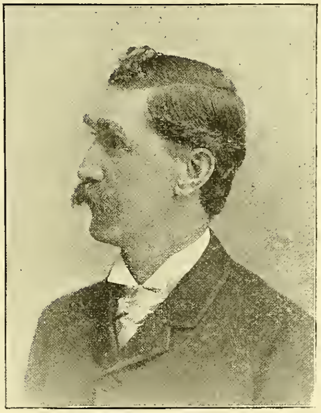
Another Minneapolis-St. Paul Line.

The Twin City Rapid Transit Company is considering the advisability of constructing a second line connecting Minneapolis and St. Paul. The property owners along the proposed route have petitioned for the building of the line, and the company has practically agreed to grant their request if a bonus of $35,000 is raised. It is thought probable that the road will be finished by June next.

Street Railway Engineers.—XXV

Thomas H. McCann.

Thomas H. McCann, chief engineer of the Jersey City, Hoboken & Rutherford Electric Railway Company, has had a practical engineering experience covering a period of thirty years. He was born in Belfast, Ireland, in 1846, and his ancestors were members of the famous Ingraham family of Leeds, England. He came to the United States when a child, and is thoroughly American so far as education and preferences are concerned. He is a veteran, having served four years in the 90th Regiment, New York Volunteers. He took part in the campaigns with Gen. Burnside, in North Carolina; Gen. Banks, at Port Hudson and Red River, and with Gen. Sheridan, in the Shenandoah Valley. After the war he was graduated from Cooper Union, and for several years was connected with the sewer department of New York City.



THOMAS H. McCANN

Mr. McCann has since been engaged in many lines in the engineering field. In steam railway work he was connected with the construction of branches of the Erie, New York Central and West Shore roads. He has been identified with all the important engineering improvements in North Hudson County, N. J., for the last twenty years. He was engineer of the North Hudson County Street Railway Company, and the elevated work and cable and electric construction was executed under his supervision. He constructed the Jersey City, Hoboken & Rutherford Electric Railway and designed the power plant, road bridges, power-houses, etc. He was the designing engineer of the Hoboken Water Works, including the Northeast New Jersey systems. He planned the sewerage systems for the drainage of the low lands of Hoboken and the sewerage systems of West Hoboken and of North Hudson County. As engineer he has also built a number of piers, crib works, docks and ferry houses on the Hudson River and has designed several public buildings and factories. He designed and constructed the famous Guttenburg, N. J., race-track and the buildings connected with it and the new Saratoga grand-stand. He is at present assistant to Chief Engineer Gustav Lindenthal, of the North River Bridge, which is to extend from Twenty-eighth Street and Sixth Avenue in New York City to the Twenty-third Street Ferry, thence across the Hudson River to Hoboken and thence through the Palisades to their westerly slope.

Mr. McCann is a member of the American Society of Civil Engineers, and as such was entrusted with the translation from the German, for the World's Fair Convention of Engineers, of Francious' report on the improvement of the River Weser from Bremenhaven to Bremen in Germany, one of the most important hydrographic works in the world.

Enthusiastically attached to his profession, Mr. McCann has always taken a deep interest in public affairs. He represents Hoboken on the Board of Trustees of Industrial Education, and was largely instrumental in introducing that important branch of training in the city. He served as a school trustee from 1884 until 1887, and was president of the Board of Education in 1886. He is enrolled in nearly all the leading clubs and social associations of Hoboken, and is an influential member of the Royal Arcanum and Ancient Order of United Workmen. He is also an active and very interested member of the State Charities Aid Association.

Meagre Opportunities in Japan.

In a recent article on opportunities for electricity in Japan William E. Curtis, in the Chicago *Record*, states that he has been assured by the Japanese Minister of Agriculture and Commerce that the government is decidedly against granting to foreigners concessions for any form of transportation or communication, or for any public improvements or conveniences whatsoever. The latter explained that the friction between the telephone, electric light, gas, water supply, railway, street-car and similar companies and their patrons was already becoming troublesome, and that parliament would very soon be compelled to enact laws similar to those in the United States for the regulation of such enterprises. It would be much easier to control and restrict them if they are owned by citizens of Japan. Foreigners would naturally appeal for protection to the diplomatic agents of their governments, and perplexing complications might ensue. Therefore the ministry, which had given the subject long and serious consideration, had decided, and he believed wisely, not to allow the control of any public works to be placed in the hands of foreigners. There was no objection to the investment of foreign capital in their stocks and bonds, but the management must be strictly native, and laws would probably be passed requiring all directors of such corporations to be subjects of the empire.

Numerous companies have been organized for the construction of electric railways in Japan, and many of them will doubtless carry out their plans in the immediate future. One proposes a trolley line in Yokohama, another an extensive system in Osaka, the most enterprising city in the empire and the second in population. Another contemplates the extension of the present trolley line in Kyoto, which is the only one in Japan. Similar enterprises are on foot in Nagoya, Kobe, Nagasaki and other places. There are also applications pending before the government for electric lines between Yokohama and Tokyo, a distance of eighteen miles, and between Kobe, Osaka and Kyoto, 48 miles, where the territory is very thickly settled ; but both of them propose to parallel steam railways owned by the government, and it is a question whether they will be permitted, for financial reasons. The present roads pay 9 per cent. and more into the public treasury, and their earnings would be reduced by competition.

Although Americans and other foreigners may not actively engage in the management of these enterprises they offer a very tempting opportunity for the investment of capital, Mr. Curtis says, and will afford a large market for steel rails of light weight and electrical material when their construction is commenced.

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MOTOR SUPPORTS.

Why should the support of a motor be more likely to fail than other parts of a car truck? This question naturally arises when the frequent dropping of a motor from its support is noted. The average weight of an ordinary street-car motor is not far from 1200 pounds, and of this about 550 pounds are sustained by the motor support. When designers instruct their draughtsmen to work up details, the latter sometimes fail to take in account the magnitude of the live load on the motor support. In the case of a motor exerting 20 hp, the 33-inch car wheel travels at 10 miles per hour, or 102 revolutions per minute, and the distance from motor support to car axle being 2 feet 6 inches, the live load will be 402 pounds. When the car ascends a heavy grade at five miles per hour the live load will have twice that value, or 804 pounds, which, moreover, is frequently delivered in the form of a blow. Existing motor supports are often found to be ridiculously small to withstand this added load. Hence their frequent failure.

ELECTROMAGNETIC TRACTION SYSTEMS.

The development of electromagnetic traction systems affords many opportunities for the exercise of inventive genius, for the problems to be solved are many and complicated. As some of these systems are now proposed for commercial exploitation, managers may soon be called upon seriously to consider them. It is safe to assert that systems of this kind must possess certain characteristics in order that they may be successful under the conditions of actual practice. First of all, the contacts must be made and broken absolutely by the devices used for the purpose, and these appliances must be so designed that the possibility of their becoming out of order will be extremely remote. A live contact in the street of a crowded city is likely to cause serious damage, and would occasion a public protest calculated to be fatal to a system causing it. The public is easily frightened, as has been repeatedly shown. In the second place, it would appear evident that no system should be installed if it necessitates making alive studs or contacts that are not immediately under the car. Persons who should cross the track and should step upon contacts made alive in front of a car might be thrown down by the shock and run over. Such a system must not be unreasonably expensive. The cost of installing it may easily be greater than that of a system involving the use of overhead wires, but it certainly must compete, so far as cost is concerned, with conduit systems of any type. Such a system to be successful must be adapted for installation in connection with existing equipments without involving extensive modifications. Should companies become willing to remove their overhead wires, they will still object to dismantling their car equipments. It will be necessary that the change to the new system should be effected by the simple addition of new devices and not by throwing aside those already in use. It is believed tnat the successful electromagnetic system must possess all the features which have been noted. Inventors are working diligently to embody these points of excellence, and it is to be hoped that they will not be turned aside from thoroughly developing their systems. It is for the interest of all concerned that the electromagnetic systems should be perfected in all details before they are submitted to the final test by the public.

FENDER SUITS.

The fender suit which was brought as a test case against one of the Brooklyn street railway companies has resulted in a victory for the defendant. The action was instituted to recover the penalty for violation of the municipal regulation which required that cars should be equipped with fenders in a certain way. Whoever read the ordinance at the time it was adopted will not be surprised that the court decided against its validity. The regulation provided that every car was to be equipped "with a safety fender or safeguard attached to the front platform * * * which shall extend * * * to within not more than three inches from the tracks and be made and modeled in such a manner that it will be impossible for any person or persons, or any article whatever to pass under the fender or platform of the car * * * and come in contact with the wheels." It requires no great amount of legal knowledge to pass on the validity of such an ordinance. Its provisions cannot be enforced for the reason that a street railway company cannot possibly comply with them. Where a car is likely to rock four or five inches it is sheer nonsense to prescribe the condition that the fender shall be attached so it shall be not more that three inches from the rails. A fender so constructed is likely to be demolished before it has been many minutes in service—especially in Brooklyn where wretched cobble paving has been laid so extensively. It was on this ground that the court set the ordinance aside. He says in his opinion: "That an ordinance should be passed that can be enforced and that devices do exist which will do the work required of the fender, I have no question, but it is for the Common Council to pass such a reasonable ordinance as can be complied with by the company, and when that is done the courts will undoubtedly enforce it. I am of the opinion, however, that no device is in existence, nor can be made, which can be run within three inches of the track. All the evidence on this trial was to the effect that a device attached to the front platform of the car in order to save life or attain the results which said ordinance was passed to accomplish could not be run safely nor with the proper effect at a distance less than six inches from the rail." objections other than those found by the court could be urged against the ordinance. It is not very clear what the framers had in mind in prescribing that the fender should be such that it would be impossible for "any article" to pass under it. The provision could not be more indefinite, and if constructed strictly, no car could be operated without violating it. This provision, had it been passed upon by the court, would have also been found fatal to the ordinance, in our opinion. As the suit was brought to test the validity of the ordinance, it is probable that all other suits of this kind will be abandoned in Brooklyn. In this connection it is interesting to note, however, that a fender, even if it does not reach the standard prescribed by the Brooklyn Alderman, is a most valuable and useful addition to a car. Some interesting figures illustrating this fact have just been made public by Mr. Charles S. Sergeant, of the West End road, of Boston. The type of fender used in that city is the same as that with which the majority of cars in Brooklyn have been equipped, and is by no means regarded as the best form procurable; yet, the statistics given by Mr. Sergeant prove that it is capable of performing good service. During the period from Oct. 2, 1892, to Oct. 14 of the present year, 347 persons have been struck by fenders in Boston. Of this number 301 persons, or 86.7 per cent., have escaped unhurt or with slight injuries; 40 persons, or 11.5 per cent., received injuries more or less serious, while six persons were killed. During the three years the number of car miles aggregated 52,700,000. As it appears that only one fatality occurred for every 8,783,333 car miles, it cannot be doubted that the fenders performed their work well, much better indeed than would be expected.

Agreement Not to Lay Track Invalid.

Judge Magruder has decided an interesting point in the suit of John W. Doane against the Chicago City Railway Company. In 1881 the defendant company obtained from Mr. Doane consent to lay a single track in front of his property on Wabash Avenue. He objected to the laying of a second track on the street and the company gave him a bond in which it agreed to forfeit $100,000 to him if at any time it should lay an additional track. In improving its loop terminals the company found it necessary to lay a second track, whereupon Mr. Doane insisted upon the payment of the $100,000. The company refused to settle the claim and suit was brought. The defendant's demurrer to the complaint was sustained in the Circuit Court and the judgment was affirmed in the Appellate Court. Judge Magruder's decision is to the same effect. The principal ground of the court in refusing to give judgment to the complainant is that the agreement of the company binding itself not to lay down an additional track is invalid under its legal duty to the whole public, and a company cannot abandon its duty to the public.

Victory of the Detroit Citizens' Company.

The controversy between the city of Detroit and the Citizens' Street Railway Company, of that city, was decided in the United States Supreme Court on Nov. 11 in favor of the company. The officials of the city sought to forfeit the company's charter, and the Court of Appeals for the fifth circuit decided against them. An application was made to the Supreme Court about two weeks ago for a writ of certiorari to bring the case up for review, but the Chief Justice in the decision denies it. This determines the case in accordance with the judgment of the Circuit Court of Appeals.

Electric Car Tests.

BY HERMANN S. HERING, M.E.,
Assisted by
CHARLES REUTLINGER and B. HARRISON BRANCH.

(*Continued from page 357.*)

VI.—PERFORMANCE OF CAR IN REGULAR SERVICE.

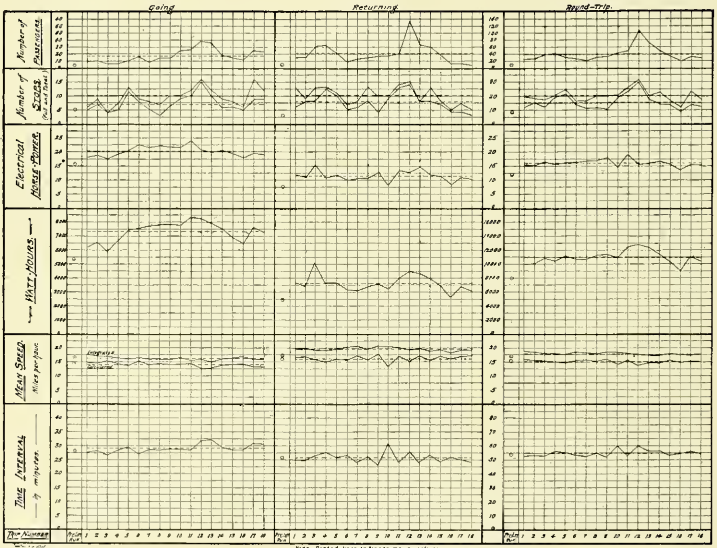
The speed curves of these Pikesville road tests are plotted in Fig. 35 in the same general manner as in the diagrams previously explained. By following up these records and comparing them with the track data, the causes of their variations can often be found. The variation in the number of stops was caused mainly by the passengers, though some may have been due to obstructions; there are also characteristic slackenings rather unfortunate to the road, due to some turnouts or sharp curves, which will be found in all the records, plotted on the same base.

In order to compare the performance of the car on the successive trips more readily, the time interval, mean speed, watt-hours, electrical horse-power, number of stops, and number of passengers, were plotted on a trip base, as shown in Fig. 36. The results are plotted for the 18 trips going, returning, and for the round trips, and show what corresponds to a load curve for the day for that car. It should be borne in mind that the trip going is up-hill and returning is down-hill, which accounts for the differences between these two sets of curves. The mean speed is plotted both according to the integrated values and to those calculated from the time interval. It will be observed that the time interval varies with the number of stops, being somewhat irregular, and that the calculated speed is also irregular, being computed from the time interval. The curve of the integrated values, therefore, gives the results which are most likely to be correct and can be used for comparison.

Miscellaneous.—In order to determine what effect the manner of handling the controller has upon the watt-hours consumed, the car was taken out on the Pikesville road on the day preceding the regular test just described, and a preliminary run was made by one of the electrician's assistants, who was given orders to handle the car in the most careful manner, using the minimum current, and to run as near the schedule time as possible.

The number of watt-hours used on this trip was 73 per cent. of the average for all the trips going, and 68 per cent. of the trips returning; compared with four trips of the regular service tests, in which the number of stops and passengers were nearly the same as in this special test, the proportion was 85 per cent. going and 74 per cent. returning, a saving of 15 and 26 per cent., respectively, or an average of 20 per cent. The results of the tests are given in the lower part of Table 11, and the speed records in Fig. 35. The reason why the difference is greater on the return trip is because it is mostly down-grade and advantage was taken by letting the car drift as much as possible, though running close to the average schedule time. The low value of the return trip of No. 16, Table 11, indicates that the motorman drifted considerably during this run. The difference on the outgoing trip is due mainly to the careful handling of the controller.

After special observation and further tests it was found that the amount of energy used by the same motorman on successive trips under the same conditions of load, stops, etc., was the same within about 2 per cent. and mostly within less than 1 per cent. It is reasonable to expect motormen to acquire a regular way of running, when they make from 3,000 to 10,000 trips a year over the same route; on this Pikesville road, for instance, they make about 5,500 trips, or about 77,000 car-miles a year. An exception must be made, however, when they are behind time or making "supper trips." The difference of 20 per cent. in the watt-hours used by these two motormen, therefore, represents average conditions and not exceptional ones, but for the sake of avoiding possible exaggeration and allowing that such expert motormen cannot be readily obtained, it would be perfectly safe to halve this figure and take 10 per cent. as the amount of energy that can readily be saved by more careful handling of the controller, while on most roads the larger value, or at least 15 per cent., could be saved without doubt. Subsequently a number of similar tests were made which corroborate these deductions.



Note Dotted lines indicate mean values
See Table of Sundry Data for Observed and Computed Results.
Equipment: 2-25 H.P. No. 3 SR Westinghouse Motors, Controller

FIG. 36.—PLOT ON A TRIP BASE OF THE TEST OF CAR NO. 234.
DURING ONE DAY'S REGULAR SERVICE ON THE PIKESVILLE ROAD, NOV. 3, 1894.
DETAILED DATA IN TABLE 11.

A few calculations based on a saving of 10 per cent. may be of interest. The cost of the energy affected by this saving may be assumed to be 1 cent per kilowatt-hour, which is much below the probable cost in average practice, but is taken as a safe and possible figure. The

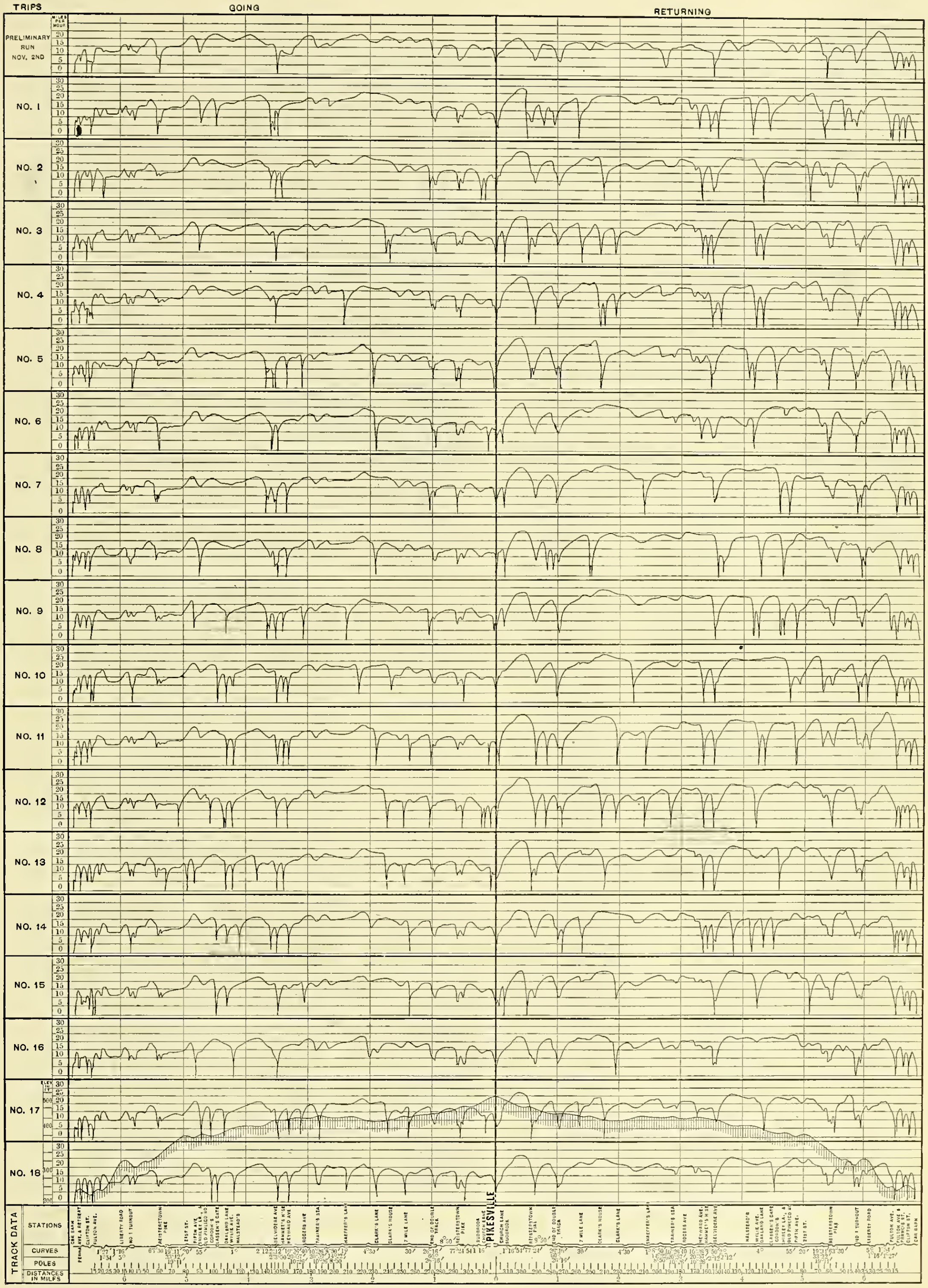


FIG. 35.—SPEED RECORDS OF CAR NO. 234 DURING ONE DAY'S REGULAR SERVICE,
ON THE PIKESVILLE ROAD OF THE BALTIMORE TRACTION COMPANY, NOV. 3, 1894.
DETAILED DATA IN TABLE 11.

gain that would result by using less power on the line will be computed on this basis.

From Table 11 it is seen that the average watt-hours per car-mile for the day on the Pikesville road is 800, or 10,915 for the round trip. A saving of 10 per cent. is 1,092 watt-hours, which, at the rate of 1 cent per kw-hour, is 1.09 cents per trip. As the cars make 18 trips per day, this amounts to 19.6 cents per car per day or $71.60 per car per year. The data from the Lake Roland road given at the top of the table shows 1,167 watt-hours per car-mile and 11,801 watt-hours per round trip to be the average. A saving of 10 per cent. of this at 1 cent per kw-hour is 1.18 cents per trip, and as the cars average 14 trips a day, this amounts to 16.5 cents per car per day and $60.30 per car per year; as they operate 14 cars on this line this amounts to $844 per year for this one line. These are both suburban roads. Taking the average performance in city running on a 10-mile, 15-car, 15-trip road as 1,300 watt-hours per car-mile, a 10 per cent. saving amounts to 1.3 cents per trip, 19.5 cents per car per day, $71.20 per car per year, and $1,067 per year for the entire road, or for a company operating 100 cars this amounts to over $7,000 per year.

These figures may appear startling at first, but they are based upon data obtained from a large number of tests, and under the conditions of actual service, and are by no means extreme or unusual values; they can be taken as very fair values, and err in being too small rather than too large. They show the importance of properly training the motormen and inspectors, as the ordinary motormen of to-day undoubtedly use more energy than is necessary. The effect upon the schedule is very slight, not more than about 2 per cent. increase on the Pikesville road, and the slight increase of the running time to effect this saving, would amply repay the company, and would scarcely be noticed by the passengers.

From these tests and others made subsequently for the purpose of verification, it was found that the difference between running past a station and making a stop and start averaged about 85 watt-hours, the values ranging from 75 to 100 watt-hours according to the grade and load, but from about 100 tests the average for all conditions is about 85 watt-hours per stop; this, it should be clearly understood, is the difference between stopping and not stopping. On the same basis of one cent per kw-hour this amounts to .085 cent per stop, nearly one tenth of a cent. At this rate the cost of making one extra or unnecessary stop on each trip would amount to 1.28 cents per car per day for 15 trips, $4.67 per car per year; for 15 cars, $70 per year, and for 100 cars, $467 per year, merely for one extra stop per trip.

(*To be continued.*)

Test of a Fender in Scranton.

The effectiveness of a fender in saving life was shown in Scranton, Pa., a few days ago. William Stetter, who is slightly deaf, was crossing the North Main Avenue tracks at 9.30 o'clock when car 113 struck him. Stetter fell into the fender and was carried about 200 feet. He sprang out when the car had slackened its speed sufficiently. He was badly frightened, but with the exception of a slight bruise was uninjured. During his experience Stetter did not lose the pipe which he was smoking.

Harold P. Brown.

Of late, Mr. Harold P. Brown, of New York, has taken an active part in the discussion of the electrolytic problem, and his name is associated with one of the most interesting methods suggested to overcome the trouble arising from the escape of electric railway currents. Mr. Brown was born near Chicago, in 1857, and he comes of a representative American family. One of his ancestors built the first detached dwelling house at Plymouth. Three of his ancestors were officers in the Revolution, and another member of the family was distinguished in the War of 1812. His father was made a brigadier-general for bravery at the Battle of Kenesaw Ridge during the Rebellion. He was prepared for the mining engineering course at Harvard, but the great Chicago fires of 1872 and 1874 so crippled the family finances that the plan had to be abandoned. From 1876 to 1879 he was engaged in the development of some of Mr. Edison's early electrical inventions. For the next five years he was in charge of the northwestern business of the Brush Electric Company, and made many improvements in arc-lighting machinery. In 1884 he started a successful business as electrical expert, and equipped a laboratory in which were developed a number of inventions in electrical distribution and lighting.

HAROLD P. BROWN.

He moved to New York in 1887 and made an investigation of the many fatal accidents from arc-light circuits in the Spring of the following year. In an article for a prominent New York paper, he described life-protecting apparatus for such circuits, and gave free use to the public of the devices which he recommended. References to a new system of current distribution caused a bitter attack to be made upon him. He subsequently conducted an extended series of careful experiments to determine the danger points of various currents. Mr. Brown considered that the method adopted in New York State for executing criminals by electticity sustained the position which he had assumed. One of the results of the controversy, he states, was the adoption of a higher standard for commercial wiring.

Mr. Brown has served as consulting electrical engineer for the State of New York, the State Board of Health, the Edison and General Electric companies and many of the principal electric railways. He has spent some years in experiments at the Edison laboratory in perfecting contact devices and finding a permanent remedy for the electrolysis of underground pipes, and has co-operated with Mr. Edison in several inventions in this line. His system for this purpose is successfully used by a number of large railway companies.

Electric Funeral Car.

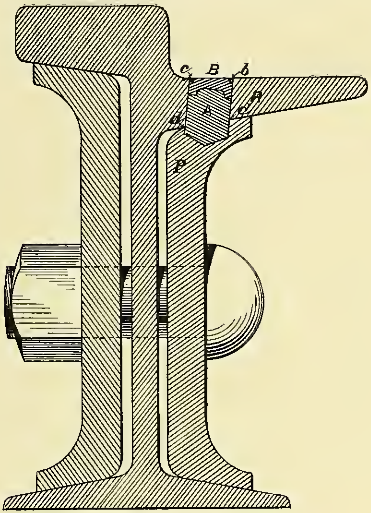
The Calumet Electric Railway Company, of Chicago, is constructing a funeral car which may be chartered to run to Oakwoods Cemetery. The car will be similar in respect to arrangement and appearance to funeral cars operated in other cities.

Rail Bonds.

In the early days of the electric railway the return circuit was neglected to a very great extent. At the present time, however, the necessity of making the return as efficient as possible is thoroughly appreciated, and no little ingenuity has been expended in developing bonds to connect the ends of the joints. There is no doubt that the use of improved devices of this kind is the part of wisdom. With poorly connected joints the waste of power becomes a large item and the electrolytic evil is aggravated. We present descriptions and illustrations of some of the best known types of rail bonds:

New Form of the Plastic Rail Bond.

A new type of the plastic rail bond has been recently devised by Harold P. Brown, of New York, to meet the growing demand for a method of rebonding old rails in paved streets without disturbing the paving and to be proof against corrosion or hammering. Near the end of each rail a hole is bored through the lower lever of rail surface, into, but not through, the top of the angle plate. The drill has a point with a very obtuse angle, and as it penetrates the lower surface of the rail it carries down a burr into the upper surface of the angle plate. This burr is partly cleared away as the hole progresses in depth, but a part of it is crowded back into the layer of rust between the two steel surfaces, forming a telescope joint which is perfectly smooth on the inside. The drill is wet with a solution of soda and water instead of oil, so as to prevent the trouble which follows the use of an insulating fluid on a contact surface. The hole is amalgamated by dropping in a piece of Edison's "solid alloy" and wetting the surfaces. This makes a layer of brilliant color which will not rust nor will it permit the steel below it to rust.



PLASTIC BOND.

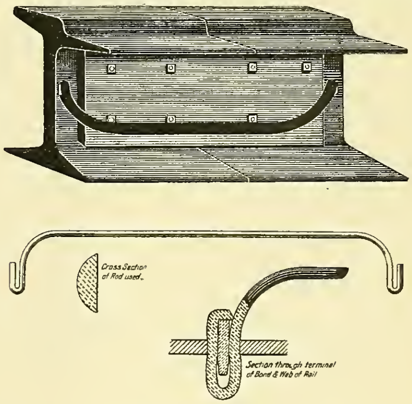
The hole is then partly filled with the plastic alloy, which adheres to the prepared surface of the hole and forms a conducting path of very low resistance between the rail and the angle plate. A soft iron-plug is then forced in as a stopper. The plug has a fillet cut away near the top, and into this fillet a part of the surface of the rail is forced by a hammer blow on a blunt chisel.

It is claimed that the conductivity of the completed joint, with a ⅝-inch hole, is equal to a copper bond ⅞-inch in diameter; or with a ⅞-inch hole, is equal to a copper rod one inch in diameter. As the plastic alloy remains soft no harm can result to the joint from the slight motion of rail and angle plate as cars pass over. For rebonding T-rails the hole is bored through the bottom of angle plate into, but not through, base of rail. In the accompanying cut the plastic plug bond is shown applied to a girder rail, *R*. The hole *A* is bored with a slight slant through *R* into top of angle plate *P*. The drill carries down with it a portion of the lower surface of *R*, and fills the cap between the surfaces, as shown at *d*.

The hole, after amalgamation, is partly filled with the plastic alloy and is then stopped with the soft iron plug *B*. This plug is slightly tapered and is driven down, preferably by screw pressure. As its surface has been amalgamated it also is rust-proof. It is locked in place by the burr *c*, made by a blunt chisel, forcing the metal of rail into the space left by the fillet *b* on the plug. This plastic plug bond is not designed for new work, as it does not give the same result as the cork type of the plastic bond, which, it is claimed, makes an electrically continuous rail. But the expense of tearing up the pavement and removing angle plates makes the new type preferable except on large roads where it is desired to obtain the full conductivity of the rails. With a drill driven by a motor connected with the trolley wire, and with the proper templates to secure proper location and slant and depth of hole, the plastic plug bond can be easily and rapidly applied even while the road is in service.

The Teck Bond.

The Teck bond was designed by the Technic Electrical Works, of Philadelphia, to afford a permanently secure electrical connection at small labor cost. The device consists of a copper wire or wedge with its end bent at right angles. The bent portion is provided with a slot through which a pointed steel key or wedge is driven. The key is slightly larger than the slot, and its action is to force the copper over the edge of the holes into close contact with the rails, and to spread the ends so that the bond is practically riveted into place.

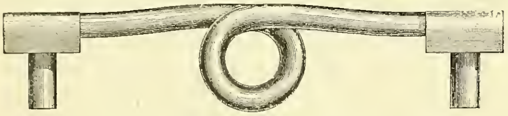

Cross Section of Rod used.
Section through terminal of Bond & Web of Rail
TECK BOND.

This device is claimed to be very reliable, and can be very quickly applied.

A large number of bonds of this type have been in use for some time, and has, it is claimed, given good satisfaction. To meet the demand for increased contact with the rail the "Improved Teck" bond has been designed. This consists of a copper rod half round in section, with its ends bent so as to bring the flat sides close together. A key or wedge is driven between the reversed end and the main body of the copper rod, making a close contact with the rail, and forming an enlarged terminal entirely of copper. It is claimed that the contact with the rail is about eight times the area of the rod. The extreme end of the rod is beveled so that it can be bent over the end of the key, and therefore cannot become loose. The device is being introduced by the Young Nut Lock Company, of New York.

Wightman Bond.

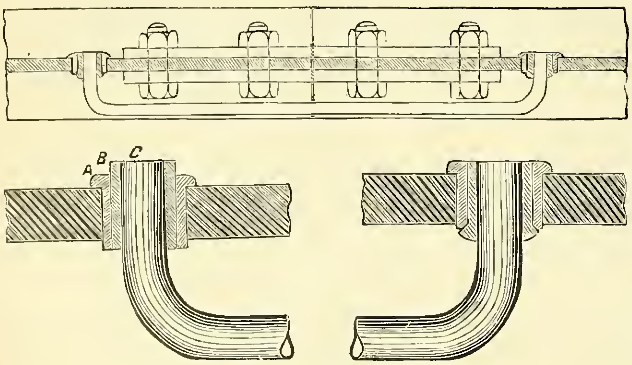
One feature of the Wightman bond, upon which great stress is laid, is that the point of greatest strength is at the connection with the rail. The possible loss of contact where the rivet is welded to the wire is compensated for by the increased surface. It does not require a skilled mechanic to apply the bond properly. It is claimed that it is impossible when the bond is riveted not to secure a satisfactory air-tight and water-tight joint. Whether the hole is a trifle too large or too small, the bond, when riveted, makes the joint perfect. The bond is made in different sizes of wire and rivets, and is furnished in solid, bare, tinned or insulated copper wire, or flexible iron wire. The manufacturers are H. J. Wightman & Co., of Scranton, Pa.



WIGHTMAN BOND.

The American Rail Bond.

In applying the American rail bond the principle of the driven wedge is adopted, and it is claimed that by this plan it is possible to obtain a firmer and closer contact with the rail than by means of any process of cold riveting. With the large and practically solid copper terminals the highest degree of electrical efficiency is obtained. The size of the terminals is so designed that the surface contact of the bond with the rail is sufficient for the highest conducting capacity of the bond wire. As shown in the accompanying illustrations, the device consists of an outer bushing, *A*, which slips freely into the tapering hole in the web of the rail. An inner bushing, *B*, is provided, its outer surface being tapered to conform to the inner surface of the bushing *A*. The bond wire *C* is inserted in the bushing *B*, and when driven into the rail it is claimed that the wire is so powerfully gripped that it is impossible for it to jar loose under the heaviest traffic, giving at the same time a surface contact equal to a oooo wire. When the terminals are driven home the inside bushings are turned over with a crescent-shaped caulking tool, forming a still firmer contact between the bond and the rail.



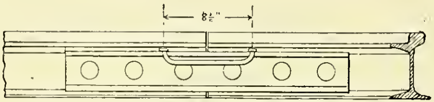
AMERICAN BOND.

In special work and at crossings and switches, and the numerous places where irregular work is necessary, this type of bond is especially valuable as any length of bond is instantly available by cutting from the coil the required length of wire.

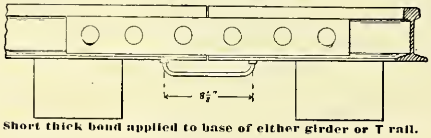
The bond is manufactured by the American Electrical Works, of Providence, R. I.

Solid One-Piece Bond.

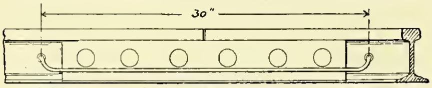
In designing the solid one-piece rail bonds the manufacturers proposed to overcome the possibility of the attachment becoming loose. This fault, they claim, is likely to follow a form comprising several parts. It is stated that by the use of a solid, jointless bond this trouble is wholly obviated, and that when it is applied the rails are able to carry the entire current back to the power station. The illustration shows the method of attaching the one-piece bond, which is made by the Benedict & Burnham Manufacturing Company, of Waterbury, Conn.



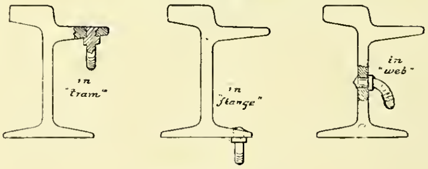
Short thick bond applied to "tram" of girder rail, allowing constant inspection.



Short thick bond applied to base of either girder or T rail.



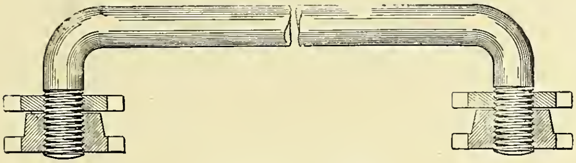
Solid long bond clearing the fish-plate in either girder or T rail.



ONE-PIECE BOND.

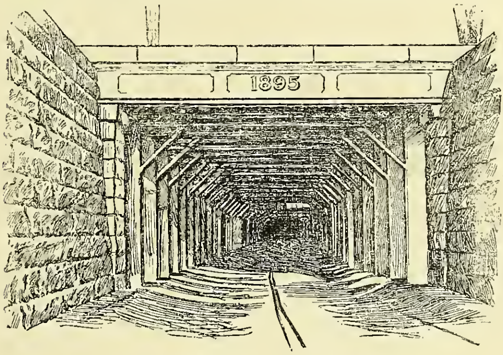
The Johnston Rail Bond.

The Johnston bond is the result of intelligent electrical and mechanical study and long experience. It is said to overcome the ordinary faults and prevent leakage, damage and waste. By reason of the large surface of the nuts and their flanges the contact with the rail is equal to twelve times the area of the cross-section of the copper conducting-rod. The surfaces are first made smooth and bright by a special tool, after the rail is in position. The holes for the nuts are also tapered and made bright by the use of a special reamer, and the nuts are then tightly screwed up. The bright, smooth surfaces of the steel rail and brass nuts and their flanges provide a firm electrical, mechanical, water-tight contact, with all the possible solidity obtained by the use of bolts and nuts. It is claimed that this fastening cannot shake loose under the most severe traffic, and it is reinforced by slightly upsetting the protruding end of the copper rod on the end nut after the whole is in place. After the bonds are installed the joints may be soldered, and thoroughly coated with a suitable paint. Besides ordinary wrenches, only two special tools are required, and skilled labor is not actually necessary to apply the device. The bond was invented by A. Langstaff Johnston and is manufactured by the John A. Roebling's Sons Company.


JOHNSTON RAIL BOND.

The Boston Subway.

The Rapid Transit Commission of Boston made its first annual report to the Board of Aldermen of that city on Nov. 11, giving in detail the progress made thus far in the solution of the problem of improved transportation in the congested sections of the city. The commission in its account calls attention to the many advantages which will follow the completion of the subway and recommends an extension of the system so as to admit of the transfer of steam cars between the northern and the southern depots. The report contains illustrations showing the development of the incline on the Public Garden. There are also several diagrams of the projected work, and the advantages of the system over the present method of surface transportation are fully explained. The subway destroys but little property, and renders it possible to run cars at a high rate of speed between stations with safety. By means of a sub-subway at junction points, grade crossings are avoided and the danger of collisions is eliminated. This arrangement also obviates delay and increases the capacity of each track.

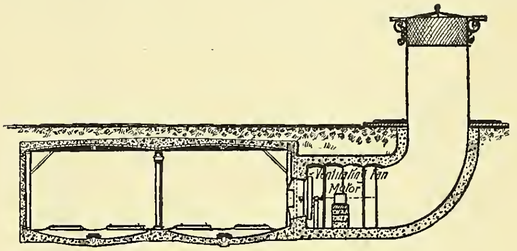


COMPLETED SECTION OF SUBWAY.

The length of the subway from the entrance near the junction of Shawmut Avenue and Tremont Street to the Union Depot will be about one and one third miles, and the distance from the Boylston Street entrance to the Union Station is about the same. The total length of single track will be about five miles.

There will be four tracks on Tremont Street along the line of the Common. Each one of the tracks will have a greater capacity than either of the present surface tracks, as the subway tracks will be absolutely free from the interruptions and delays to which the surface roads are subjected. The present delays and confusion at the Granary burying ground will be avoided by means of a loop. Cars reaching the end of the trip at Park Street, after depositing passengers, will pass around a loop from the incoming to the outgoing track.

The motorman will not be obliged to change from one end of the car to the other, and certain lines of cars will always start from one side of the platform, and other lines from the opposite side, so that passengers will naturally divide themselves according to their destination on the two sides of the platform. The platforms will be sixteen feet below the surface of the street and the stairways leading to them will be shorter than those of the average elevated railway stations.



METHOD OF VENTILATING SUBWAY.

The subway will be lighted by electricity, which will be supplied from a special lighting plant separate from the station which will supply the current for operating and lighting the cars.

Excellent arrangements have been made for ventilating the subway. Fresh air will be drawn in at the stations, and will flow in each direction to the fans where it will be exhausted through special openings at the side of the tunnel. The fans will be operated by electric motors, and the drainage of whatever water may find its way into the subway will be effected by pumps operated by electric motors. Drains will be laid in the ballast and will lead to the lowest points where the pumps will be located. Arrangements have been made to insure dryness in the subway by using a concrete bottom and by covering sides and top with water-proof coating.

The Rapid Transit Commission will be required to build a bridge over the Charles River, between the present Charles River Bridge and the Fitchburg Railway Bridge. The new bridge will have a roadway 100 feet in width, and there will be a clear height of not less than 17 feet, nor more than 23 feet above high water, so that a considerable portion of the traffic on the river can pass up and down without necessitating the opening of the draw.

The commission has been requested by the city to report on the probable cost of constructing a tunnel to East Boston, and plans are now being prepared by the chief engineer. The total expenses of the commission to August 15, 1895, were $917,255.40.

FINANCIAL NOTES.

THE WEST END (BOSTON) STREET RAILWAY EARNINGS for October are reported as being $40,000 larger than for the same month in 1894.

THE METROPOLITAN TRACTION COMPANY, New York, has secured another important addition to its system by the lease for a long term of years of the lines owned by the Eighth Avenue Railway Company. The deal was made some days ago, but the terms are withheld for the present. They are said to include a guarantee of a dividend of 15 per cent. a year on the capital stock of the Eighth Avenue Company, which amounts to $1,000,000, and which the company paid in the year ended June 30, 1894, 13 per cent. The company has also $1,000,000 ot funded debt. The Eighth Avenue line runs from 153d Street down Eighth Avenue through Hudson, Canal, West Broadway, Chambers, Church and Vesey Streets to Broadway, with a branch also through Canal Street to Broadway—a total of 20 miles of track.

COLUMBUS (O.) STREET RAILWAY EARNINGS.—The Columbus Street Railway Company's statement of operations for the month of October, in comparison with the same month last year, is as follows: Gross earnings, 1895, $52,058.95; 1894, $49,086.95; increase, $2,972.00. Operating expenses, $26,806.78; 1894, $23,963.35; increase, $2,843.43. Net earnings, 1895, $25,252.17; 1894, $25,123.60; increase, $128.57. It will be seen that, while there was an increase in gross earnings of $2,972, augmented operating expenses aggregated $2,843.43, leaving the increase in net earnings only $128.57. Although no explanation accompanies the statement, it is quite likely the increase in operating expenses for the month was brought about by preparation for Winter traffic. The showing for the ten months ended Oct. 31, as follows, is very good: Net earnings for 1894, $248,509.90; for 1895, $268,621.04; increase, $20,112.04.

NEW INCORPORATIONS.

NEWARK, O.—The Newark Consolidated Electric Railway Company has been incorporated in West Virginia by Reinhardt Scheidler, J. A. Flor, John Schlagal, F. A. Crane and W. C. Christian, Newark, O., for the purpose of constructing and operating an electric railway in Newark. Capital stock, minimum $500, maximum $250,000.

NEW ALBANY, IND.—The Highland Railway Company has been formed for the purpose of owning and operating a railway in New Albany to be operated by steam, electricity or other motive power. Those interested are Henry Terstegge, John M. Shrader, Jacob Zinsmeister and Charles Schwartzel, New Albany, Ind. Capital stock, $25,000.

BARRIE, ONT.—Letters patent have been issued incorporating the Barrie & Allendale Electric Street Railway Company, with a total capital stock of $50,000. The promoters are J. H. McKeggie, J. Vair, G. Reedy, S. J. Sanford and J. Dickinson, all of Barrie, and the object of the company is to construct and operate an electric railway in Barrie, and a mile and a half beyond.

ALBANY, N. Y.—The North End Street Railway Company was incorporated last Saturday to construct a street surface railway 13 miles in length in New York City. The termini will be at the intersection of Manhattan Avenue and 116th Street and at the intersection of Kingsbridge Road and the northerly city line, with branches extending from the intersection of Eleventh Avenue, or the Boulevard and Broadway, to the intersection of Broadway with Amsterdam or Tenth Avenue; from the intersection of Riverdale Avenue and Kingsbridge Road to the intersection of Riverdale Avenue and the northerly city line; from the intersection of 145th Street and the Boulevard to the intersection of 145th Street and the Harlem River, and from the intersection of Manhattan Avenue and St. Nicholas Avenue to the intersection of St. Nicholas Avenue and 126th Street. The company is capitalized at $5,000,000.

NEWS OF THE WEEK.

CAMDEN, ME.—The extension of the electric railway in Camden is in contemplation.

VINCENTOWN, N. J.—It is reported that the Vincentown Branch Railway will be converted into a trolley line.

WILMINGTON, DEL.—Another effort is being made to build an electric road between Wilmington and New Castle.

NEW HAVEN, CONN.—New Haven City Council has granted additional franchises to the Winchester Street Railway.

RANDOLPH, MASS.—The Board of Selectmen has granted a franchise to the Braintree & Holbrook Street Railway Company.

KEENE, N. H.—The contract for building an electric road at Keene has been signed by the Keene Electric Railway Company.

EASTON, PA.—The Easton Transit Company has been granted permission to lay tracks on Adamson Street, Odenweldertown.

CAMDEN, N. J.—The Camden, Gloucester & Woodbury Railway Company has been granted permission to build a trolley line in front of Cooper School.

MADISON, WIS.—H. C. Adams and W. T. Fish have secured a franchise from the town to construct and maintain a street-car line. Estimated cost, $20,000.

NEW LONDON, CONN.—The New London Street Railway Company has asked the right to extend its road to the Waterford line on the Norwich Turnpike.

NEWARK, N. J.—It is proposed to extend the trolley lines along the old Brookfield road, from Mt. Prospect Avenue through Delaware Avenue to Forest Hill station.

ELIZABETH, N. J.—A syndicate has been looking over the turnpike road from Elizabeth to Summit, with a view to building a trolley line between the two places.

ALLEGHENY, PA.—The City Council has passed an ordinance granting permission to the Federal Street & Pleasant Valley Railway Company to build a line along Charles Street to Perryville Avenue.

NEW ORLEANS, LA.—The City Attorney has decided that the New Orleans Traction has the right to extend its tracts along Villiere Street, and the work of construction will probably be commenced at once.

WEST CHESTER, PA.—Efforts are being made by representatives of a syndicate of New York and Philadelphia capitalists to obtain right of way between West Chester and Quakerville for an electric trolley road.

MONTREAL, QUE.—Application has been made to Parliament for an act to incorporate the Montreal & St. Lambert Bridge & Electric Company to construct a railway and highway bridge across the St. Lawrence at Montreal.

CHESTER, PA.—Engineer Roberts is making a survey of the route for the extension of the Prospect Street Railway on the northwest side of the P. W. & S. R. R., to run through Folsom, Rutledge and Morton to the Baltimore Pike.

PITTSBURG, PA.—It is reported that a number of Pittsburg, New Castle and Beaver County capitalists have effected an organization and will shortly apply for a charter to build a rapid transit electric line from Pittsburg to New Castle.

LOWELL, MASS.—The citizens of Tewksbury have voted in favor of granting the Lowell & Suburban Company right of way through several streets, and there is little doubt that a formal franchise will be at once granted by the authorities.

FALL RIVER, MASS.—The Globe Street Railway Company is marking out the places for the trolley poles in the extension of its line from the corner of Bedford and Hafford Streets through Hafford and County Streets and Eastern Avenue.

CATSKILL, N. Y.—Catskill, Cairo & Windham Street Railway Company proposes to build a street railway about 10 miles long in Greene County, from Long Dock, at Catskill Landing, on the Hudson River, through Catskill to the village of Cairo.

BALTIMORE, MD.—The Northeast Baltimore Improvement Association has passed a resolution instructing the Committee on Railways to urge the extension of the Hall Springs Road from Girardville, the present terminus, to Parkville, Baltimore County.

MORTON, PA.—President Crosby M. Black, of the Prospect Street Railway Company, expects to extend the new line from Moore Station to Morton, a distance of two and a half miles. The line will connect with the Delaware County & Philadelphia Electric Railway.

DUNMORE, PA.—A charter has been granted to the Dunmore Street Railway Company to build a line five miles long. Capital stock $30,000. John M. Burke, of Scranton, president; Frank Silliman, Jr., Horace B. Hand, Robert T. Fox and Joseph H. Hiesland, of Scranton, directors.

SOUTH HAVEN, MICH.—The business men and fruit growers of this vicinity are agitating the building of an electric road from Saugatuck to Benton Harbor. Many of the fruit growers between here and Saugatuck are anxious for the construction of such a road, and will give the right of way.

BRISTOL, PA.—A large force of laborers, many of them from Bristol, went to Terresdale to-day to commence work on the extension of the trolley road from Terresdale to Bristol. It is thought that the line will be built to Bristol by New Year. The surveyors have reached to within a few miles from Terresdale.

AMBLER, PA.—It is reported that if a franchise can be obtained on favorable terms, a branch electric road will be established over the Chestnut Hill and Norristown line of this place. The residents along the Chestnut Hill and Spring House division of the Bethlehem turnpike are being asked to consent to the construction of the trolley road.

MILFORD, PA.—The building of an electric railway between Frenchtown and Pittstown is talked of by the citizens of these two towns and the residents along the proposed road. Many of the property owners have already offered the right of way free through their properties, and it is thought other property owners will do the same.

PHILADELPHIA, PA.—It is stated that the trolley road of the Pennsylvania Railway Co. from Burlington to Mount Holly has so far given satisfaction, and will, in all probability, be extended to Vincentown and Medford. The company has lately adopted an air brake similar to the one in use on the steam trains, and it works admirably.

FENTON, MICH.—An electric railway from Fenton to Flint is promised. John E. Nolan, of Saginaw, has a franchise on the streets of Flint, and the Fenton Common Council was instructed at a citizens' meeting last week to grant a franchise in this village. The new line of road will connect with Long Lake and make it one of the leading Summer resorts of Central Michigan.

NEW HAVEN, CONN.—Announcement is made that a new electric railway is to be built and put in condition to operate by early Spring to connect existing lines in Hartford with the City of Rockville, thus making a through line from the capital city to one of the most bustling centres of the State. It is thought this will furnish serious competition to the New England road.

CHARLESTON, S. C.—The City Railway Company has elected the following directors for the coming year: John S. Riggs, George W. Williams, Andrew Simonds, G. Lamb Buist, H. H. DeLeon, John F. Ficken, Morris Israel and Edwin P. Frost. At a subsequent meeting of the newly elected Board of Directors Mr. John S. Riggs was unanimously elected president and Frank F. Whilden secretary and treasurer.

PHILADELPHIA, PA.—It is rumored that the Union Traction Company is considering the advisability of taking the Seventeenth and Nineteenth Street cars off Chestnut and Walnut Streets and making the line straight, north and south, on Seventeenth and Nineteenth Streets. There is a probability that the service on the Seventh and Ninth Street line, from Broad and Cambria Streets to Seventh and McKean, will be reduced, the travel having fallen off considerably.

DENVER, COL.—In our issue of Nov. 2. under this date line, the name of E. C. Randell was given as being that of the general manager and purchasing agent of the Denver, Globeville & Golden Rapid Transit Company. The secretary of this company writes us, however, that no one of that name is connected with the company. Dr. L. E. Lemen is President; S. Roy Wright, Vice-President and General Manager, and Robert C. Lingo, secretary.

THE PROVIDENCE CAR FENDER, built by the Consolidated Car Fender Company, of 181 Canal Street, Providence, R. I., has been adopted by the Fitchburg (Mass.) Street Railway Company, and its entire system is now under process of equipment with this admirable device. The Providence fender is also being applied to the entire system of the Hartford (Conn.) Street Railway Company. This is a gratifying order to Col. Woodworth, as it was given after severe tests and a trial even of another fender upon several cars of the system.

AYLMER, QUE.—Mr. Viau, owner of the franchise for the proposed line of electric railway between Hull and Aylmer, is negotiating a deal with New York capitalists for completing the road. He is now negotiating with the farmers along the proposed line for right of way, and he says the result is more satisfactory than he had expected. He secured his charter from the Quebec Government in spite of a strong political influence that was at work against him, as there were a number of others who wanted the charter.

PHILADELPHIA, PA.—Postmaster Carr proposes to rearrange the trolley car system in this city to meet the criticism of the Second Assistant Postmaster-General, who has stated that the system here has not been as successful as it has been in other cities. Postmaster Carr will probably ask Councils to pass an ordinance permitting a siding to be laid in front of the post office on Market Street, where the mail cars can be run without interfering with the other cars on the route, and to locate the sub-stations on the streets on which the trolley mail cars will run.

PHILADELPHIA, PA.—The Camden Horse Railway Company, for the purpose of encouraging its employees, and also for the protection of its patrons, will offer cash prizes for efficiency and good deportment. On the 1st of January next the company will divide $250 among the motormen and conductors, and every three months thereafter a cash prize of $500 will be distributed. The conditions of the competition are that only those employees are eligible who have avoided accidents, have not been reported for any cause or have not been suspended for violation of the rules.

WOBURN, MASS.—Woburn will soon have extended electric street railway facilities. The North Woburn Company is contemplating the construction of a road from North Woburn to Wilmington, where connections may be made with the Reading & Lowell Road. This latter street railway will be open to the public early in December, and will be operated during the Winter. A continuous line between Lowell and Lynn via Wakefield will be established, and with the connecting link at Wilmington will give electric car service to Boston via the North Woburn and West End systems.

PHILADELPHIA, PA.—When the street railway companies of Philadelphia were granted franchises for the construction of trolley lines, one of the conditions provided was that the companies should pave the streets through which their lines ran. During the last few months the streets have frequently been torn up by contractors, and the paving, it is claimed, has not been put back in its original condition. The companies have therefore recently joined in remonstrances to the City Councils, setting forth that they would not be responsible for breaks in the road which were made by other companies and improperly repaired.

SHELBURNE, ONT.—Subscriptions toward the promotion of the proposed Port Perry & Kincardine Electric Railway have been readily secured here, and an amount has been promised in excess of that asked for by the promoter, Mr. A. E. C. Pew. The road will extend through a populous and fertile section of country, and will be the only railway connecting Lakes Ontario and Huron from east to west. It will intersect numerous other lines of railway, and will carry to and receive from them both passengers and freight. It will be operated by water-power, an ample supply of which is available on different sections of the route.

HOBOKEN, N. J.—The Hudson County Board of Freeholders have refused permission to the Jersey City, Harrison & Kearney Railway Company to build a bridge over the D., L. & W. tracks at Sanford's Crossing, near Harrison. The application has been before the Board since last May. The Harrison & Kearney Company is a part of the Consolidated Traction Company's system. At the place where the company wants to construct a bridge the passengers are obliged to leave the trolley cars and walk across the D., L. & W.'s tracks to the other side. The Board's refusal was based on a report of a committee that a crossing would be very dangerous to human life.

PHILADELPHIA, PA.—The Philadelphia & West Chester Traction Company expects to go into court this week and ask that the injunctions now pending against the road be dismissed. The company has been running the old Frankford "dummies" on its line ever since an injunction was granted preventing the company putting up poles and stringing wires. A few months' experience with the "dummies" has had the effect of making many of the objectors change their minds, and it is expected that all opposition to the trolley will be removed. Should this expectation be borne out it is the intention of the company to at once substitute electricity for its present power.

LYNN, MASS.—Col. Charles F. Woodward, president of the Reading & Lowell Street Railway Company, states that work is progressing rapidly on the new road and that its construction is now just about half completed. There are three gangs of men at work and it is the company's desire to rush the work as rapidly as possible until the completion of the road. The residents along the route of the proposed road are enthusiastic over the scheme and are awaiting the opening of the line with much interest. The road will probably be ready for operation by the first of December, and, when once started, it will be run continuously throughout the Winter from Lowell to Lynn, via Reading and Wakefield.

BELLEVILLE, N. J.—On last Saturday night the Consolidated Traction Company extended its trolley line from Newark through Belleville to Essex without the sanction of the Township Committee of Belleville. The tracks were laid years ago, and horse cars were operated upon them over the whole Belleville township length of one mile for a one-cent fare. The Consolidated Traction Company, in trying to get a franchise to use electricity, refused to abate that one-cent fare if transfers were to be given in Newark in every direction, but offered to carry passengers to Newark for five cents upon a transfer east on Market Street. With a transfer in any other direction the company insisted that the fare would not be less than six cents. The Belleville authorities refused to give the franchise on any other terms than general transfers at five cents, and the Consolidated Company set a big gang of men at work, and in 24 hours had put up poles and wires. On Saturday evening two decorated and illuminated cars ran over the line and made a sensation in sleepy old Belleville. They ran a few free trips and then put on a car which is now making regular trips. The hurry in equipping the road was provoked not only by a desire to get it done ahead of any injunction, but to get the start of the Passaic & Newark road, which is coming down the same avenue and is now within a mile of Essex.

A MULTIPLICITY OF RECEIVERS IMMINENT.—It seems likely that a number of the lines of the Milwaukee Street Railway Company will, before long, be overburdened with receivers. Judge Johnson, in the Circuit Court, has issued an order requiring Washington Becker and the West Side Street Railway Company to appear in court on Saturday morning at 10 o'clock and show cause why the property of the company should not be sequestered and a receiver appointed for the same. The application for the appointment of a receiver was made by Somers & Somers, representing Robert Stephan and John Archer. Executions were issued a few days ago in favor of Stephan for about $9000, and in favor of Archer for $5000, and they were returned by the sheriff unsatisfied, hence the present proceedings. The motion for the appointment of a separate receivership for the Milwaukee Street Railway Company will come up before Judge Ludwig on Saturday. It is probable that proceedings will also be instituted shortly to restrain the sale of the property of the Milwaukee Street Railway Company and its reorganization. There are unsatisfied judgments and claims against the company to the amount of nearly $125,000, and it is claimed that the road has been mortgaged in excess of its valuation and purchase price for the purpose of evading the payment of those just claims.

TRADE NOTES.

THE SHULTZ BELTING COMPANY, of St. Louis, is distributing its belting over all the world. An order has just been received from Johannisburg, South Africa, for over 3000 feet of belting in various widths and lengths, a goodly portion being double belting.

THE HEINE SAFETY BOILER COMPANY, of St. Louis, Mo., is constantly reaching out in a quiet sort of way for business—and getting it. Among the recent orders are one from the Rockford Sugar Works for a 1000-hp boiler and one from the Fairbanks Company, Chicago, for a 250-hp boiler.

FRED. M. LOCKE, of Victor, N. Y., has issued a neat catalogue of his high-insulation line material, which includes a triple petticoat china insulator, the merits of which are being universally recognized by railway men. The insulator has over 12 inches of surface between the supporting pin and the wire, and nearly 10 inches of this surface is on the under side of the insulator, out of reach of the rain, etc. Mr. Locke's "indestructible" steel insulator pin is also meeting with much favor among constructing engineers, and numerous testimonials have been received concerning its value in practical work.

THE ROBINSON ELECTRIC TRUCK & SUPPLY COMPANY has just issued a handsome pamphlet as a souvenir of the Montreal convention of the American Street Railway Association. The cover is illustrated by a handsome view of the shipping district of Montreal, and the pamphlet contains a number of illustrations of cars on different roads equipped with the Robinson's radial track, as well as a great deal of interesting explanatory matter.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., has just completed for the Somerville Woollen Mills, at Somerville, N. J., a spinning room 54 feet wide and 210 feet long, and a boiler room 40 feet wide and 216 feet long. The construction of the spinning room is steel trusses, with heavy plank floors and roof. The boiler room is constructed with brick walls, steel trusses and corrugated steel covering.

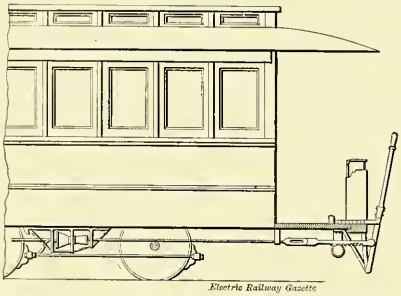
MISCELLANEOUS NOTE.

THE SECOND ANNUAL BALL of the employees of the Safety Insulated Wire & Cable Company will be given at the Murray Hill Lyceum, 160 East Thirty-fourth Street, New York, on Tuesday evening, Nov. 26.

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED NOV. 5.

549,094. BRAKE FOR ELECTRIC OR OTHER CARS; Edward S Amrock, Waltham, assignor of one half to James H. Walsh, Boston, Mass. Filed March 16, 1892. A hydrostatic bellows has heads of different areas, the large head being connected to the brake beam and the small head to a rod with a furcated end in which a rack bar is free to slide. This bar is connected to the operating lever and the rack is in gear with a pinion on a shaft which carries a sprocket wheel for operating the chain of the electric switch. (See Illustration.)



549,094.—BRAKE FOR ELECTRIC OR OTHER CARS.

549,127. FENDER FOR STREET CARS; Carl A. Hallquist, Brooklyn, N. Y. Filed June 3, 1895. The fender consists of a chair pivoted on supporting arms extended forward of the platform of the car, the apron being jointed to the front edge of the chair seat and having wheels or rolls to carry the front edge when depressed. Springs normally support the front edge of the apron above the roadway, and a ratchet and pawl support the springs, the springs behind the chair having support against the pendant arms of the car.

549,136. STREET CAR LIGHTING; Frank E. Kinsman, Plainfield, N. J. Filed Feb. 27, 1895. Lamps are located in series with a branch of the main circuit line, and a storage battery is in circuit in parallel with the branch. Supplemental lamps are in circuit with the storage battery and are located in the car and also in the headlight. Means are provided for controlling the current in the branch for lighting the supplemental lamps in case the others fail.

549,153. CONTROLLING ELECTRIC MOTORS; William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Aug. 8, 1895. The patent covers the art of controlling electric motors by the three-wire system, which consists in connecting two motors between an outside main and a neutral, with a resistance in series with the motors, cutting out the resistance, then re-inserting the resistance and shunting one of the motors and then connecting them respectively between the two outside mains and the neutral.

549,187. TRACK DRILL; Louis J. Crecelius, St. Louis, Mo., assignor to Andrew Warren, same place. Filed March 4, 1895. Locking pieces are loosely seated in recesses in the spindle and engage the flukes of the drill. The recesses have contracted inner faces whereby the locking pieces are prevented from dropping out when the drill is removed. Means are provided for imparting longitudinal movement to the drill within the spindle.

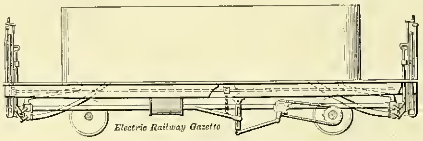
549,256. FENDER ATTACHMENT FOR TROLLEY CARS; Henry F. Risch, Brooklyn, N. Y. Filed August 4, 1894. The fender is provided with side arms and elastic and inwardly curved corner pieces arranged at the side of the arms, while an elastic fender net connects the front ends of the corner pieces.

549,316. SAFETY ATTACHMENT FOR STREET CARS; Albert E. Hughes, Darien, Conn. Filed Feb. 21, 1895. The wheel guard for the car consists of long, flexible fingers or members arranged closely together and projecting from the car downwardly toward the ground, normally clearing the same. When necessary the fingers can be jammed endwise against the ground for preventing a person from passing under them. The fender has a curved screen mounted in front of the dashboard and adapted to be slid downwardly and forwardly in the arc of its curvature. The shield consists of a sheet of rubber placed forwardly of the screen and covering the same when in a retracted position, but forming substantially a continuation thereof when the screen is projected.

549,328. FARE REGISTER; Albert Pfaff, Newark, N. J. Filed March 31, 1894. One or more feed cylinders has vertical grooves in the periphery thereof and are joined by oblique grooves. One or more trip registers or numbered drums are employed and the mechanism engages with the grooves in the feed wheel or wheels to operate the same when in engagement with the oblique grooves, and are connected with and operate the trip register or numbered drums. A slide is adapted to reciprocate in a guide and an arm is pivotally connected with the slide, a lever being used for operating the arm.

549,415. CAR FENDER; Alpheus A. Williams; Orange, N. J. Filed April 17, 1895. The front end of the car is provided with castings, which are provided with upwardly extending projections. There is a frame in front of the car, the side plates of which are provided with perforated projections to engage with the projections of the castings. There is a yielding cushion between the plates, and the hinged portion in front of the plates is provided with a yielding cushion, the front of which is provided with a yielding roller. At each end of the roller there is a yielding pulley. Means are provided for formally holding the hinged portion above the track.

549,437. STREET SPRINKLING APPARATUS; Louis W. Camphell, Waco, Tex. Filed Dec. 5, 1894. A force pump is carried by the car, which has a tank for holding the water, and mechanism which is operated by the motion of the wheels operates the force pump. A distributing pipe leads from the pump and a by-pass valve is connected thereto. A two-way valve alternately directs the flow of water either through the distributing pipe or through the by-pass pipe, whereby a continuous flow of water from the pump may be provided for. Independent means regulate the output of the pump, and so control the flow of water from the distributing pipe. A perforated pipe is connected directly to the bottom of the tank, and is operated by gravity. A valve controls the flow of water from this pipe. A hand-lever is connected both to the last-named valve and to the two-way valve, and is adapted to operate both simultaneously. (See Illustration.)



549,437.—STREET SPRINKLING APPARATUS.

549,469. STREET-CAR SIGN APPARATUS; William H. Swift, Boston, Mass., assignor of one half to John H. McGrady, same place. Filed Dec. 10, 1894. This is a rotatable end sign having a shaft in gear which extends longitudinally of the car. There is a rotatable side sign out of alignment with the shaft, and sprocket wheels are applied to the shaft and the journal of the side sign. A sprocket chain engages the wheels, and a cover or casing protects the wheels and chain.

Electric Railway Gazette.

Vol. XIII. NEW YORK, NOVEMBER 23, 1895. No. 21.

Storage Battery System on the Madison Avenue Line, New York.

Electric traction systems which do not depend upon the use of overhead wires are to be thoroughly tested in New York City. Most of the companies are anxious to abandon animal power and to substitute some more modern system. The attitude of the local authorities is such, however, that no plan involving aerial wires is feasible. The Metropolitan Traction Company and the Third Avenue Railway Company have determined to test the merits of conduit construction. As both of these companies operate their main lines by cable it was natural that in their search for a new system they should decide upon one that could be adapted to the cable if success was not attained. The New York & Harlem Railway Company has decided to introduce the storage-battery system in an experimental way on its Madison & Fourth Avenue line. The company has already had some experience in accumulator traction. Julien storage-battery cars were operated on the line a few years ago, and their subsequent abandonment was attributable not so much to the failure of the system as to unfortunate litigation.

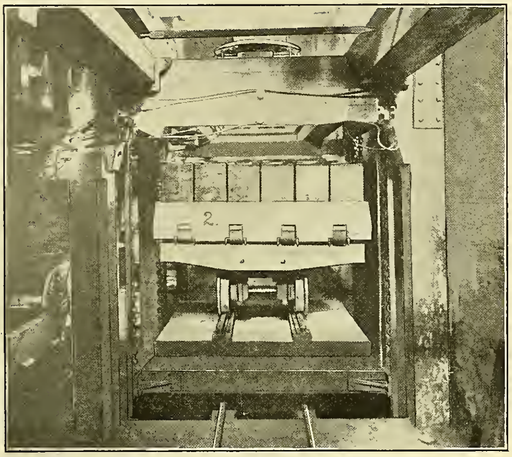


FIG. 1.—ELEVATOR AND BATTERY TRUCK.

The contract for the installation of the new system, which is to be given at once a thorough trial, has been entrusted to the Electric Storage Battery Company, of Philadelphia. It is not influenced in any respect by the failures that have been encountered heretofore. It is confident that a storage-battery traction system can be made so successful that the advantage of substituting it for animal power will be apparent. No expense will be spared in the installation, and as the company now owns almost all valuable storage-battery patents it will not be likely to be hampered by legislation. It has been free to use any form of grid which it deems best adapted to the purpose, and, as a matter of fact, the nine-plate cell of the chloride type will be used.

To demonstrate the possibilities of the new traction system the Electric Storage Battery Company has equipped two cars. One of these has already been operated in trial runs, though it has not yet been put into regular service. The cars were built by the John Stephenson Company, of New York, and are handsomely finished and decorated. They have double doors and ventilator roofs extending the full length of the bodies. They are lighted by two chandeliers of three lamps each.

The trucks were constructed especially for the purpose by the Peckham Motor Truck & Wheel Company. They are extra long and unusually substantial. The motors are hung from the axles on the sides opposite to those which they occupy in the ordinary equipment, as shown in Fig. 3. They are of the G. E.-800 type, and are wound for 120 volts.

The middle of the truck is left free to receive the equipment of batteries which are carried as shown in Fig. 4. The storage cells are 60 in number and are grouped in two batteries of 30 each. The controller is a modification of the General Electric K type, and is designated as K. S. B.; the meaning of the last two letters is obvious. The controller has six notches arranged in pairs, making connections, as shown in Fig. 5. Nos. 1, 3 and 5 are running notches, and when these positions are used the car gives the maximum economy. Each of the chandeliers in the cars is connected to one of the batteries, so that in case of trouble with one battery the other will be available to furnish illumination. Each equipment is provided with a special box containing voltmeter contacts so that the expert can always determine the condition of the batteries and ascertain if a sufficient charge is present to furnish power for operating the car until it returns to the charging station again.

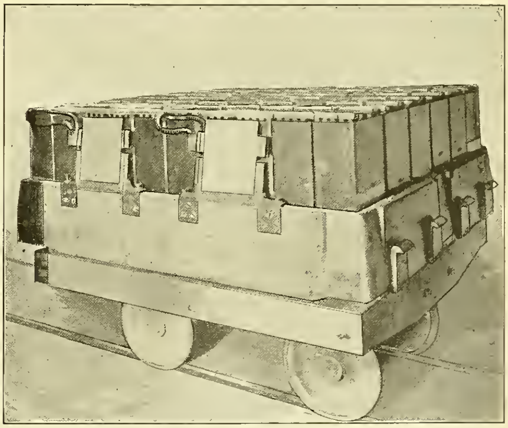


FIG. 2.—BATTERIES ON TRUCK.

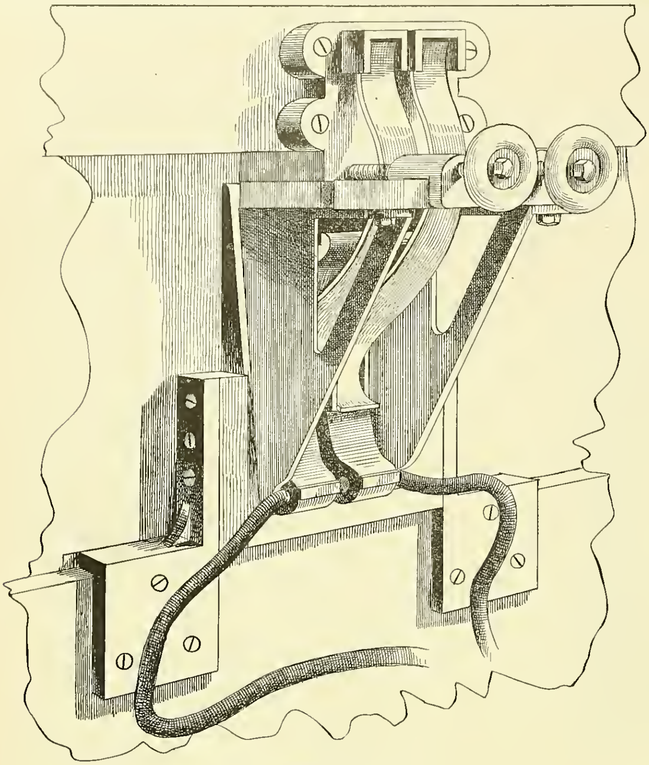


FIG. 7.—CONTACT DEVICE.

The plant which is required in connection with the operation of the cars is located at Eighty-sixth Street and Madison Avenue. A part of the car barn at this point has been set apart for the purpose, and the necessary equipment has been installed by the Electric Storage Battery Company. Provision has been made for quickly furnishing cars with charged batteries and for as speedily removing the discharged cells. The various plans for this part of the work have been carefully worked out, and much ingenuity has been shown in perfecting the details of the arrangement. It has already been stated that the 60 cells occupy a position in the centre of the truck. They are carried in a tray, to the bottom of which are attached four channel irons. To the ends of the latter are riveted wrought-iron hooks, which snap upon spring-pressed supporting bars on the truck, holding the tray securely in position.

The cars enter on the street level, and the cells are raised on the tray from the basement into position by means of an elevator, Fig. 1, operated by an electric motor. The elevator is arranged in accordance with the Sprague system.

It is obviously necessary that the elevator should carry its tray exactly into position. As it would be out of the question to stop a heavy car within an inch or two of the required point, an automatic centering arrangement, Fig. 6, which consists of a movable bumper on the car track capable of adjustment for a distance of about 14 inches, has been devised. From the bumper a lever extends to guides at the side of the elevator pit. The movement of the lever is communicated to the guides, and they are caused to swing longitudinally into such a position that the tray slides, as it is raised, into its proper place, and the hooks hold it securely.

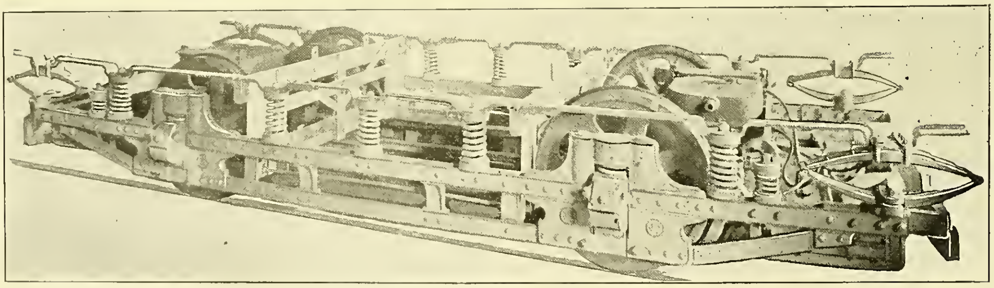


FIG. 3.—TRUCK SHOWING POSITIONS OF MOTORS.

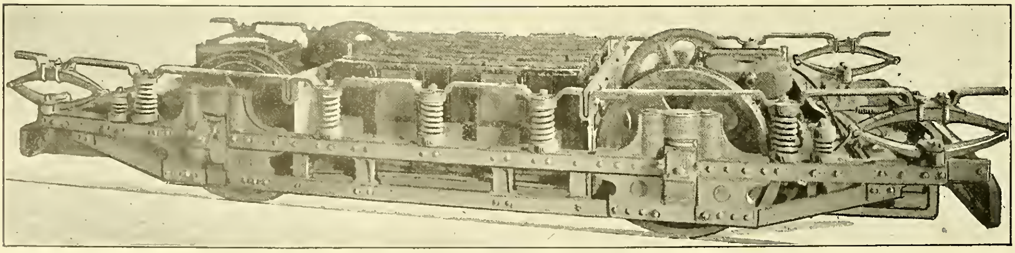


FIG. 4.—BATTERIES IN PLACE.

Upon the withdrawal of the elevator the car is ready for service. The removal of the discharged cells is as easily effected. The elevator is raised into position, the supporting hooks are released and the batteries then rest on a truck, Fig. 2. The elevator carries its load to the basement, and the cells are run into the charging room. It is stated that a change of batteries can be effected in about 30 seconds.

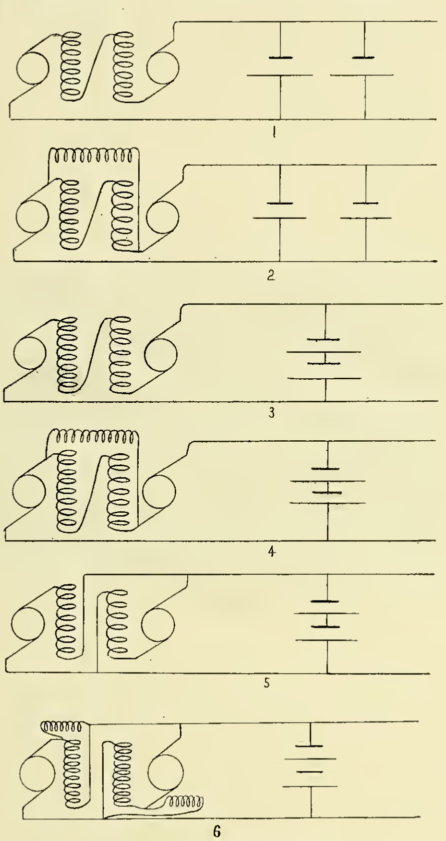


FIG. 5.—CONTROLLER POSITIONS.

The terminals of the battery make automatic contact when it is hoisted into position, and the mechanism used for this purpose is ingenious. It is illustrated in Fig. 7. A flat, brass plate on the side of the battery box impinges against two blocks similar to that shown in Fig. 8, and the latter are held against cross plates on the sides of the tray by flat springs, as shown in Fig. 7. These blocks are absolutely insulated from any part of the mechanism which presses them against the plates. The tension of the flat springs is readily adjusted by two tension screws. Two of these blocks connect one terminal of the battery, an identical apparatus being used for the other connection. It is a fact worthy of note that in the arrangement of the cars all parts of the equipment are in duplicate, that the possibility that it may become disabled is reduced to the minimum. All the battery connections are burned together and the terminals are double cables.

The generating plant consist of a 21-hp gas engine and a 16-kw General Electric M. P. generator, but the company hopes to add a 36-inch Otto gas engine, and a 30-kw generator within two weeks. The charging switchboard is interesting. The batteries are charged in series and interposed in the circuit are two cut-outs, one of which acts if the current falls below 10 amperes, and another if the current rises above 100 amperes. This makes the charging of batteries almost automatic. The charging switchboard is of polished slate and consists of five panels, each containing a switch and an ammeter. The totalizing ammeter and voltmeter together with the cut-outs before mentioned complete the present equipment. A new panel will be added to the switchboard when the plant is increased.

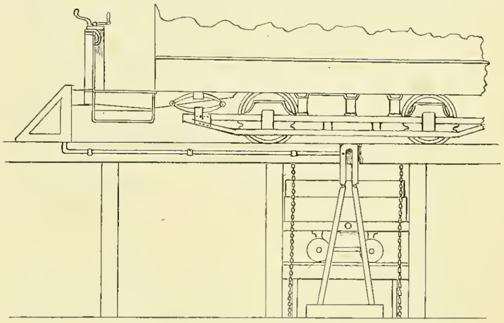


FIG. 6.—CENTERING DEVICE FOR BATTERY TRAY.

When the system is introduced on a larger scale it is proposed to vary the battery equipment of the cars. A car traversing a route without grades will carry, for example, a lighter weight of batteries than one which must surmount grades and travel over slippery rails. The fact, however, that the cars will be independent units is considered to compensate for the weight of the equipments.

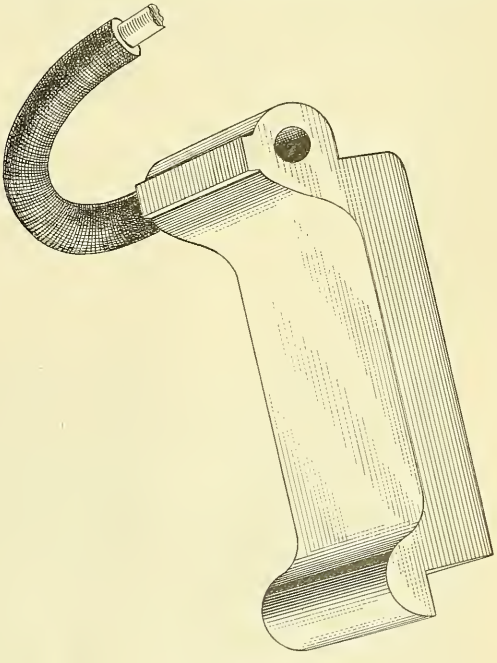


FIG. 8.—CONTACT SHOE.

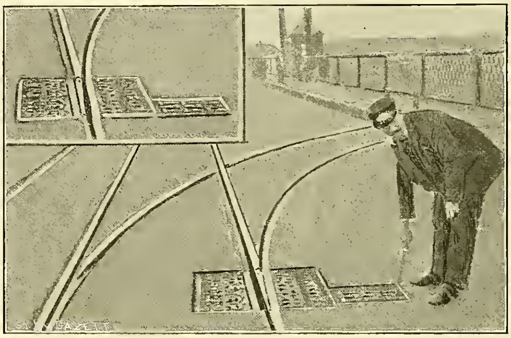
The Cleveland Disaster.

The most terrible catastrophe in the history of electric railways occurred in Cleveland on last Saturday evening. A car plunged through the open draw-bridge of the Central Viaduct, and fell a distance of 100 feet into the Cuyahoga River, causing the death of at least 17 persons. The responsibility for the disaster cannot at this time be fixed, for several matters bearing upon the question are still in dispute, but there is a substantial agreement as to how the accident occurred.

A car on the Jennings Avenue line of the Cleveland Electric Railway Company started to cross the viaduct from the Cleveland side at about 7.30. It was one of the new combination cars, and its equipment appears to have been in perfect condition. It was occupied by about 20 passengers, and was in charge of experienced men. The conductor, Edward Hoffman, who was one of the victims, had been in the employ of the company for several years, and had held the position of conductor for a year and a half. The motorman, August H. Rogers, who narrowly escaped death, had been employed for four years. Both men had clean records and were regarded by their superiors as careful and reliable.

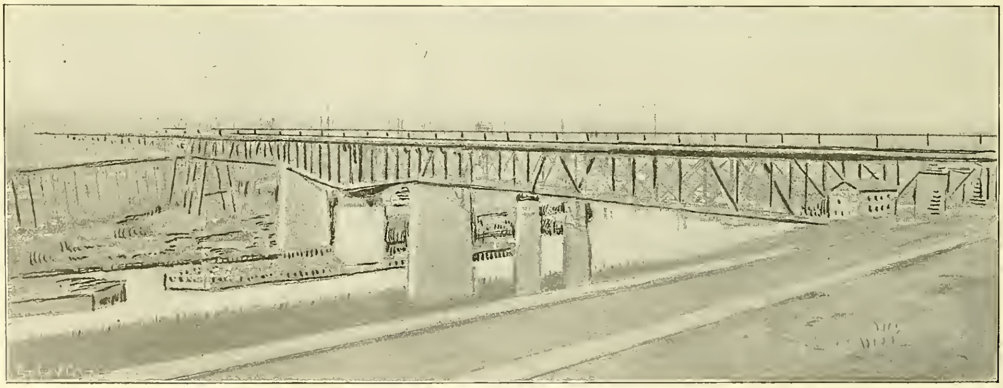
One hundred feet from the draw a derailing switch is located. In order to pass this point it is necessary that the conductor should go in front of his car and by a chain hold the switch closed, as shown in the accompanying illustration. When the chain is released the switch opens automatically, as shown in the small illustration, and when it is in this position should the car proceed it would run off the main track. This device has recently been adopted as an additional precaution. Before it was put in service dependence was placed upon a cut-out located about 200 feet from the draw-bridge. When the latter was turned the power was cut off for a distance of about 200 feet on each side.

When the car reached the switch Saturday evening Hoffman ran in front of his car as usual, drew up the chain and signaled to the motorman to proceed. He failed to notice that the draw was open. It was dark and somewhat misty at the time, but not foggy, so that there was no reason why he should not have seen the red danger lights on the protecting gates at the edge of the draw, if they were burning. Whether the lamps were lighted or not is a disputed question. The bridge-tender positively states that the lights were burning in their proper position, and a person who was with him at the time vouches for the truth of his assertion, but statements to the contrary have been made. If the lamps were burning, certainly Hoffman did not see them, or he would not have ordered the motorman to advance. The latter's vision was somewhat obscured by a film of moisture on the vestibule window, and he turned on his current without question. There is another point which is not quite clear. It does not appear that the company had discontinued the use of the cut-out 200 feet from the draw, but it certainly was the fact that it did not act on the evening in question. The bridge-tender states that the cut-outs had not been working for two weeks. What the trouble was that prevented the cutting off of the power has not yet been disclosed. The fact remains that there was current on the line when the draw was open and Rogers, the the motorman, started his car at the usual speed.



DERAILING SWITCH ON CENTRAL VIADUCT.

He had proceeded a short distance when the bridge-tender noticed his approach and called out to him to stop his car. Evidently he failed to understand the warning at first. He was but a few feet from the draw when he applied the brake and he did not have time to reverse the motors before the car crashed through the gates and then toppled over into the river. At the last second the motorman and one or two of the passengers jumped from the platforms and were saved. In its descent the car struck the ledge of the stone pier, 12 feet below



CENTRAL VIADUCT IN CLEVELAND.

the roadway, and then plunged into the river. It fell between the tug and the vessel for which the draw had been turned and cut the connecting tow-line. One passenger in the car made his escape in some way and was rescued. Although badly injured he will probably recover. As soon as the motorman came to his senses after jumping from the car he gave the alarm by his cries and caused the police to begin at once to hurry to the scene in boats in the hope of rescuing some of the unfortunate passengers. No one was found alive, but the work of recovering the bodies was continued unremittingly until 17 had been found. The motorman was arrested and the charge of manslaughter was made against him, although it is the general belief that far less blame attaches to him than to the conductor who, if he was careless paid the penalty with his life.

Overhead Feeder and Trolley Construction of the New Orleans Traction Company.—II.

BY W. NELSON SMITH, M. E.

The largest size of copper cable employed is 500,000 circ. mils, and the smallest wire is No. 0 B. & S. All wire is triple-braided and is from several of the best mills in the country. The trolley wire is all of the usual standard size, No. 0 hard-drawn copper. The span wires are of 17-64 inch galvanized iron stranded cable, and for guying various sizes of galvanized iron and steel wire rope are used, varying from ⅜ inch to 1 inch in diameter, according to circumstances. That most used is ½ inch galvanized steel of seven strands.

The average distance between poles is 90 feet, on trunk line No. 1; on those built subsequently it is 100 feet. The deflection of the cables from the horizontal at the centres of spans is about 2 per cent. As the cable weighs nearly two pounds per running foot, it is obvious that great care must be exercised in properly guying any pole where the line is obliged to turn a corner, however blunt the angle may be; also the cross-arms and appliances used to support the cables on the poles must be of special construction, so that the extra lateral stress will not wrench them apart. For turning an obtuse angle a special cross-arm is used of standard dimensions, but provided with large porcelain knobs secured with 2 inches x ½ inch iron braces and ⅝ inch bolts, instead of the usual glass insulators and wooden pins. The porcelain insulators are bushed with wood. (See Fig. 2.)

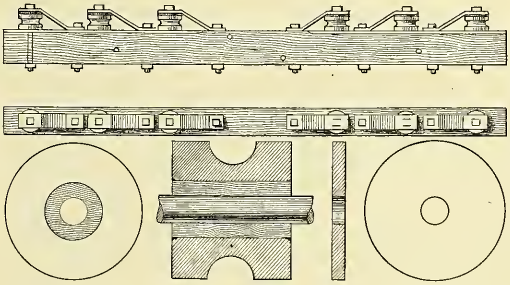


FIG. 2.

For turning a square corner and for convenience in branching the sub-feeders from the trunk-lines, the "junction frame" was devised, mechanical details of which are shown in accompanying drawing, Fig. 3. Instead of wooden cross-arms, 4 inches x 4 inches x ½ inch angle iron is employed. Two long pieces carry the weight of the frame and connections, and two short ones on top of them transmit the stresses from the frame to the pole. The end-connectors of the cables are attached by double "giant strain" insulators to the eyebolts in the sides of the frame. Electrical connection is made by running a bus-bar around the top of the frame on top-groove insulators, into which run "jumpers" from all the cables "dead ended" at the frame.

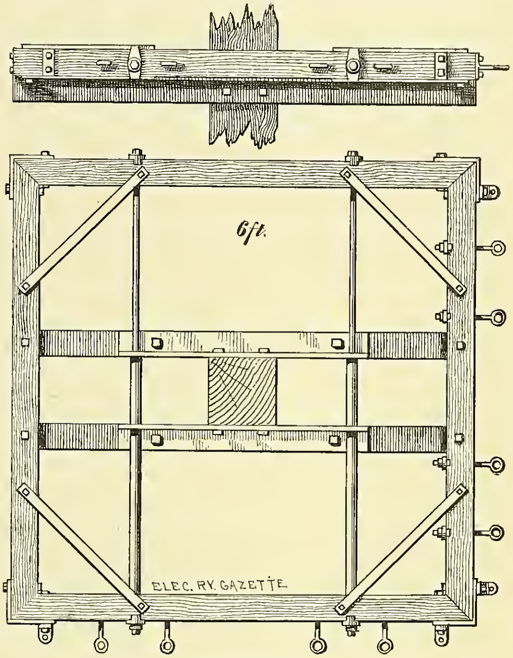


FIG. 3.

The greatest care has been exercised in the erection of the guys and guy stubs which anchor the numerous corner and junction poles along the trunk lines. The guys for these poles are of ½ inch and ¾ inch galvanized wire rope, fastened with clamps and thimbles. While various styles are in vogue, the one preferred is the short "V-guy"; that is, the point of the V where the main guy cable is attached is only 8 or 10 feet from the frame, and there is no tendency for the sides of the V to twist around each other at the point, as is the case with a long V. At the stub, the main cable is attached to a turnbuckle, of 1 inch to 1½ inch iron, according to circumstances. Some of the guy-stubs along the trunk lines are of wood 14 inches x 14 inches yellow pine, set in 8 feet of concrete, and raking backward. To make them still more secure, they are anchored back to old car-wheels, set in 6 feet of concrete, about 8 feet in rear of the stub, by a pair of 1 inch iron rods, which are attached to a strap that embraces the stub at the ground level. But the guy-stub, which has been found generally preferable, consists of a pair of 90 lbs. or 100 lbs. rails, or, more exactly, of a single rail cut in half and the two halves set on end, side by side, raking backward about 15 degrees, and pulling against their bottom flanges. These are set in 8 feet of concrete, with just space enough between them for a turnbuckle-eye of 1½ inch iron, which is carried by a 1½ inch bolt that runs through the webs of the two rails, about 7 feet above the ground. This stub is also anchored back to car wheels placed as described above, but by a single anchor rod of 1½ inch iron, placed between the rails at the ground level. It may be objected that an iron guy-stub may be a source of annoyance and even danger, because a guy attached to it is grounded, but it need not be so if proper precautions are taken. At poles where electric light wires increase the overhead complications, the main guy cables have had heavy strain insulators of special design cut into them, details of which will be shown later. The accompanying drawing (Fig. 4) shows a cross-section of the stub at the point of attachment of the guy.

The terminal pole of trunk line No. 1 is at the power station and its anchorage is shown in Fig. 5. The poles are 40-foot, 15 inches x 15 inches butts, and 12 inches x 12 inches tops. The cross-arms on the front of each pole are of wood, 5 inches x 6 inches x 6 feet. On the rear side of each pole, at corresponding heights, are cross-arms of 4 inches x 4 inches x ½ inch angle iron. The stresses due to the tension of the cables are eventually carried by the iron cross-arms on the rear pole, which are connected with the front ones by ¾-inch tie rods. There are two heavy vertical timbers, 3 inches x 12 inches, one on each side of the rear pole, and extending up and down over all the iron cross-arms, which equalize all the stresses from the arms and transmit them to the four V-guys, which are fastened to the equalizers by heavy iron clevises, and which run to two double-rail guy-stubs about 40 feet farther back, set as described above. The number and classification of the wires composing this trunk-line, and terminating at this particular pole, is: Seventeen 500,000 circ. mils cables; two 250,000 circ. mils cables; four No. 0000; and two No. 000. The circular millage of the wires anchored here is therefore 10,182,000. Fig. 5 is from a recent photograph of the terminal. Trunk line No. 3 is carried similarly.

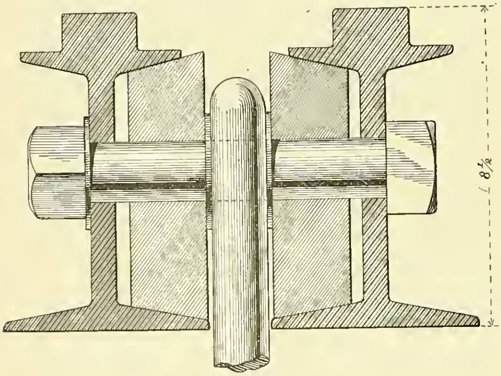


FIG. 4.

In order to secure reliable and handy electrical connection for the large cables, as well as to properly insulate them, a number of special devices were adopted. A set of samples of those principally used is shown in Fig. 6. Nearly all the copper in the trunk lines is of the 500,000 circ. mils size, and for dead-heading it and sustaining the consequent severe tensile stress (1200 to 1500 lbs.) the terminal connector shown at *A*, Fig. 6, was devised. It is of tough brass, and the body of it is tapered so that the end of the cable may be spread open before the solder is "sweated" in, thus making a connection which it is practically impossible to break. A socket is formed on one side of the connector, with set-screws, to receive the "jumper," which connects the dead-ended cable with the bus-bar on the junction frame. This socket and the body of the connector are tinned before using. The eye of the connector is pinned by a ⅝-inch bolt to a brass yoke, *K*, a pair of which are used to yoke together two Johns "giant strain" insulators. The other yoke is pinned to the eye-bolt in the junction frame. This combination forms a convenient connection of remarkable strength. None of the several hundred in use have ever been known to give away. The pieces marked *B*, *C* and *D*, also of brass, are known as "clamp T-connectors." They are used to clamp on the 500,000 circ. mils bus-bars, to receive the jumpers from the dead-ended cables, and elsewhere when convenient. The sockets are provided with set screws, and carry 500,000 circ. mils cable *D*, 250,000 circ.

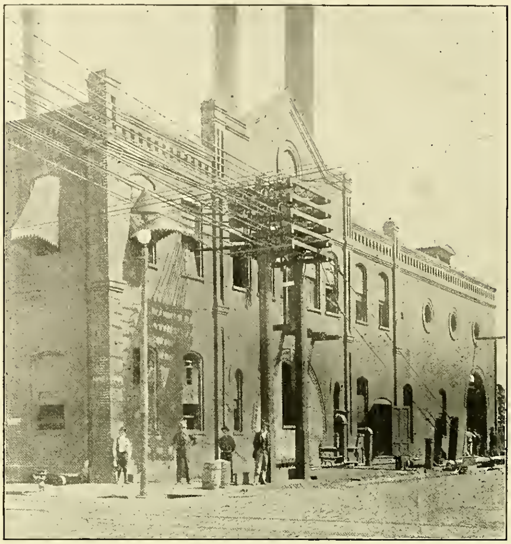


FIG. 5.

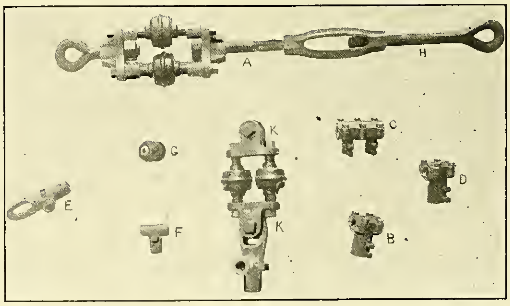


FIG. 6.

mils cable *B*, and two No. 0000 wires *C*. A solid T-connector, *F*, is frequently used, chiefly for connecting feeders into the section-boxes along the trolley lines. It carries No. 0000 wire, and has set-screws in the shank. For dead-ending, 150,000 circ. mils cable, a brass end-connector, *E*, is provided, similar to the larger size already described. It is insulated in the same way. For attaching the track-feeders to the rails, a special button-headed bolt, *C*, is used. It is of brass, one inch in diameter, and drilled lengthwise to carry a No. 0000 wire, which is "sweated" in when using. The under sides of the head and the nut are finished smooth, and the hole in the rail is counter-bored with a pin drill just enough to make a finished rail surface for the bolt to draw up against. The shank of the bolt is slightly tapered, so that when tightly drawn it is an excellent fit. The No. 0000 wire runs from the bolt to the butt of the nearest pole, and up to pole to the track-feeder cables. As many as three such wires have been connected to each rail at certain important feeding points. This method of connection has proved very efficient.

Mention has been made of a strain-insulator for use in a heavy main guy when attached to an iron stub. This is shown at *H*. It consists essentially of four Johns giant-strain insulators in "parallel," joined together by yokes of phosphor-bronze—one of the toughest alloys obtainable. The cap-screws in the insulators are ⅝ inch, and the eye-bolt and turnbuckle are one inch. It is possible to increase the latter to 1¼ inches without enlarging the yokes. Such an insulator will carry 10,000 to 12,000 pounds stress with perfect safety. When in place, all terminal and clamp connectors and Johns insulators are carefully taped and painted over with asphaltum.

The trolley construction is very neat in appearance, and has been highly complimented by experts familiar with the best current practice.

(*To be continued.*)

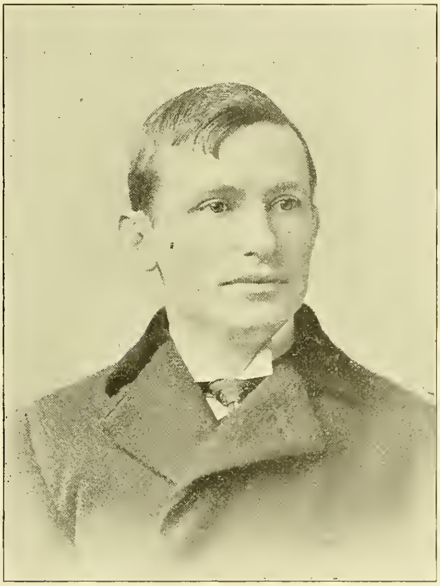
New York Rapid Transit.

An application was made to the General Term of the Supreme Court in New York City a few days ago for the appointment of three commissioners to take testimony in order to determine whether the underground roads shall be built over the routes as decided upon by the Rapid Transit Commissioners.

The Rapid Transit Commissioners made the application because they have failed to obtain the consent of a majority in value of the property-owners along the routes. The motion was opposed by representatives of property-owners, who argued that the Rapid Transit act was unconstitutional. The application was granted.

Street Railway Engineers—XXVI.

James F. McLaughlin.



James F. McLaughlin.

Mr. James F. McLaughlin, of Philadelphia, has earned a high reputation as an inventor and street railway engineer. He is only 31 years of age, but for several years he has been well known in the electrical field. He was born in Philadelphia of Scotch parents. When he was eight years of age his parents died, and he was thrown on his own resources. He attained a position as a district telegraph messenger, and, as he was industrious, he was promoted from time to time, and became a skillful operator. Subsequently he was engaged as lineman and was constantly employed in construction work. During all this time he devoted his leisure hours to study, and he gained a thorough acquaintance with electrical theories while he was increasing his practical experience. In 1878 he accepted a position with the Bell Telephone Company, in Philadelphia, and soon after made an extensive series of experiments with telephonic apparatus, leading to inventions, for which several important patents were granted to him. These are now utilized by the Bell Telephone Company. In the telephone field Mr. McLaughlin has laid claim to certain honors which the public has agreed to accord to Prof. Bell. In 1884 he made his first effort in the field of electric traction. The experiments which were begun at that time have resulted in the development of what is generally designated as the E. M. traction system. A description of the system, with illustrations of its characteristic features, appeared in the last issue of the Electric Railway Gazette. The history of the development of the system is a record of disheartening obstacles finally overcome by gritty perseverance.

Important Purchase by the New York Third Avenue Company.

The Third Avenue Railway Company, of New York, has purchased the lines of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Company. It is stated that the price paid was about $1,300,000. The latter company controls about 24 miles of track and owns 135 cars and 1500 horses. It is thought probable that animal power will be abandoned as soon as possible and the underground electric system, which the company will test on a short section of track on Amsterdam Avenue, will be substituted. The control of the road will add an important territory to that now covered by the Third Avenue Company, and enable it to transfer passengers to the Grand Central Depot on Forty-second Street, and to points on the west side.

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IMPROVED TRANSIT SYSTEMS IN NEW YORK.

Newspapers in a number of cities, especially in Brooklyn, where the overhead electric system has been installed, have enjoyed poking fun at New York because old-fashioned cars drawn by sleepy horses still traverse some of its principal business thoroughfares. The metropolitan companies have been unable to provide modern surface transportation up to this time for the reason that permission for aerial wires was not obtainable. Recently, however, the companies with one accord have determined to improve the metropolitan transportation facilities, and it is interesting to note the different electric traction systems which are to be experimentally introduced. One underground conduit system is already in operation and another will soon be ready for a practical test. A section of line is to be equipped at once with a closed-conduit system, and storage battery cars will soon be in regular operation on the Madison Avenue line. Those interested in these installations have the utmost confidence in their success, and if their faith proves to be well founded, there will be radical changes introduced in the next two years. Horses will disappear on the lines, and New York will no longer be ridiculed for its out-of-date railway equipments.

COMPOUNDING OF GENERATORS.

The theory of the compound dynamo is very misleading, and the novice in the central station who has studied it is apt to wonder why certain phenomena occur which seem to be at variance with it. Moreover, he is likely to apply a false remedy. No matter how accurately the series-coil may be shunted on an ordinary generator, it will not at once hold its voltage when it is suddenly required to meet a heavy load, and often several minutes elapse before the rated potential is again established. The inexperienced hand, seeing a fall of voltage, is apt to adjust the field rheostats to restore the pressure, and a few minutes later he is surprised to see the voltage proportionately too high. The reason is to be found in the fact that it takes time for a dynamo to compound. No compound-wound machine can be so accurately designed that this factor will not enter. The magnetism does not at once respond to the ampere-turns upon the bobbin, especially at high densities, and hence the drop in the armature, and the reactions thereof are not at once compensated for. Therefore a certain portion of the pressure must leave the terminals temporarily to supply this need. In railway generators, therefore, where the load is such a variable factor, it is wise to employ heavy magnets that are well below saturation, and laminated pole-pieces, which are of assistance in counteracting this evil.

CAREFUL MOTORMEN.

It is a well-known fact that two motormen can take the same equipment over the same route in the same time and yet use vastly different amounts of power. It is difficult to place any check on the motorman that will be strictly fair, yet some system is very desirable. It is suggested that to accomplish maximum economy the following methods be adopted : Let there be placed on every car some cheap form of recording wattmeter, whose readings shall be relatively comparative. Such an instrument need not necessarily be an accurate measurer of power, as it is simply requisite that it indicate whether more power is used on one run than another. Let the runs be made as nearly uniform as possible by establishing regular stopping-places at marked poles. Let the motormen change from equipment to equipment so that all shall have an opportunity to make a record with each car. Offer a bonus for the lowest wattmeter reading, taking into account the reading of the fare register as indicative of the passengers carried during the run. The motorman will quickly discover that it pays to be careful in his method of handling the controller. Power is now largely wasted by starting the car at full speed, instead of more slowly, by approaching a stopping-place with full current on, and suddenly throwing off the power and destroying the accumulated energy by the brake, by applying the brake when the power is on, by uselessly using current when coasting down grade, and in scores of other ways. Certain prominent companies have found that it pays to distribute as much as $10,000 a year among their employees as an incentive to induce them to be careful to avoid accidents endangering life and properry. Why should not similar methods be employed to reduce coal consumption ?

THE CLEVELAND DISASTER.

The terrible catastrophe at Cleveland, on Saturday last, emphasizes the extreme importance of protecting danger points by proper safeguards. It also serves to show that the protecting devices whenever practicable should be automatic in action, and that the least possible dependence should be placed upon human intelligence. The street railway company at Cleveland conceived that it had practically eliminated the possibility of such a calamity as that which caused the death of 17 persons a few days ago. Devices had been employed to cut off the power at points 200 feet on each side of the drawbridge whenever the bridge was opened. This plan seems to have operated in the past very satisfactorily, but for some reason which is not understood at present, these cut-outs have not of late been operative. Power, therefore, was available at all times to carry a car to the very edge of the bridge, whether it was open or not. Reliance was necessarily placed on the intelligence and discretion of the motorman and conductor. The arrangement in Cleveland is such that in approaching the bridge the car meets a derailing switch which must be held closed by the conductor. It has evidently been assumed that the very fact of the conductor's leaving his car to attend to the switch would call to his mind the necessity of carefully noting whether the bridge was open. If such was the assumption, it was not well founded. The conductor, who had been supposed to be a careful employee and faithful in the discharge of his duties, failed to notice that the bridge had been turned and signaled the motorman to proceed, and the latter discovered the mistake too late to prevent the disaster. These facts appeared to be undisputed, and in the light of them the conclusion seems irresistible that the derailing switch should be made to interlock with the bridge and that the carefulness of the conductor should be eliminated as a factor of safety. Then, should the motorman attempt to run past the switch when the bridge was open the car would simply be switched off the main lines. Employees, even the best of them, become heedless at times, and the fact that they may pay with their lives the penalty for carelessness—as did the conductor of the ill-fated car in Cleveland—is not sufficient to keep them always alert and cautious in the performance of their duties. Familiarity breeds recklessness, and is very likely in the course of time to lead to accidents. There may have been some reason for the failure of the conductor of the Cleveland car to realize the danger which existed, for there is a question whether the signals on the bridge were in position, but, however this may be, it is obvious that safety should depend not on the employee, but should be guarded by the application of automatic devices.

Conduit System to Be Extensively Introduced in New York.

John D. Crimmins, of the Metropolitan Traction Company, authorizes the statement that the company has determined eventually to operate all its lines by a uniform underground electric conduit system. It will not be practicable to make the change at once, but at the same time Mr. Crimmins says the company will be constantly working toward this end. Canvassers are now at work securing the consent of property-owners for a change of power on some of the lines now operated by animal power. The Eighth Avenue road, which was recently purchased, will be equipped with an electric system, and the Sixth and Tenth Avenue lines, it is stated, will soon be operated in the same way. It is likely that the substitution of electricity for the cable on the Broadway line will not be begun until every problem has been solved by the experience gained in the operation of the other lines. It has already been stated that the Twenty-third Street and Lexington Avenue line will be operated by a conduit system, and work has already been begun on the station at 105th Street, which is to furnish the power for the operation of this road.

Trolley Freight Line.

The Cortland & Homer Traction Company, of Cortland, N. Y., has succeeded in constructing its freight line in spite of the opposition of the village authorities of Cortland. The authorities decided to abandon their opposition to the building of the line, as they questioned the outcome of legal proceedings. The company is now carrying freight from the tracks of the Delaware, Lackawanna & Western Railway.

Electric Car Tests.

BY HERMANN S. HERING, M.E.,

Assisted by

CHARLES REUTLINGER and B. HARRISON BRANCH.

(Concluded from page 372.)

MISCELLANEOUS.

In some cities the law requires the electric cars to come to a stop before passing fire engine houses. Taking an actual instance of an engine house located where two lines of cars pass the door, 30 cars making 15 round trips a day and each car passing the engine house twice on each round trip, it is found that on this same basis it costs the railway company for electrical energy alone, 76 cents per day or $278 per year to stop their cars at this one place. Stops required by law must be made, but the question of making unnecessary stops is also one that is worthy of further attention on the part of railway managers. No data on the cost of brakes and wear and tear due to stops is at hand, but it is probably sufficiently great that it would pay to diminish it as much as possible.

The kinetic energy of one of these cars, say with a 10-passenger load, 17,200 pounds, going at a speed of 10 miles per hour, is 57,400 foot-pounds or its equivalent, 21.6 watt-hours. The difference between the amount of electrical energy required when the car stops at a station and resumes its former speed and that required to run past the station, is about 8[illegible] watt-hours. On that basis the efficiency of starting would be about 25 per cent., which is a fair average, though it may run higher in specific cases, as these figures are based on the average of a large number of tests made under the varying conditions of actual service.

It was also found that the increase of energy required per passenger per mile varies from 0.5 to 4.4 watt-hours, according to the load and number of stops made, but the average for a 20-stop, 20-passenger trip is about 1.4 watt-hours per passenger-mile or 1 watt-hour per 100 pounds per mile, or 20 watt-hours per ton-mile. This value varies greatly with the load and number of stops on the same road and on different roads, also with the character of the grades, curves, etc., but it is the average increase required per passenger obtained from a large number of tests made on the Pikesville road.

The paying load on the Pikesville road computed from Table 11 varies from 2 to 36 per cent., the average for the entire day being 8 per cent. On the city roads it is higher and runs from 10 to 15 per cent. About half the total number of passengers carried on a trip is a fair estimate of the equivalent continuous load for that trip under ordinary conditions. By reducing the weight of the car the per cent. of paying load would be increased, which indicates that it would pay better to run light cars than heavy ones, especially when the travel is light. One thousand pounds less weight on a car amounts to a saving of 10 watt-hours per car-mile, and for 160 car-miles per day, a usual average, would effect a saving of 1.6 kw-hours, which, at the rate of one cent per kw-hour, amounts to 1.6 cents per car per day, $5.84 per car per year, $57.60 for a 15-car road and $584 for a 100-car road per year, an amount well worth considering in the selection of motors and trucks, although for high-speed work the trucks must of necessity be heavy.

The main part of the power used on an electric road is required to operate the cars alone, the passengers themselves increasing the demand on the power station only a small per cent. A test of the power station of a road operating the cars on a uniform schedule throughout the day showed a practically horizontal load curve with scarcely any increase during the heaviest travel, whereas in a test made on a road where the cars were operated on the tripper system the load curve practically coincided with the curve showing the number of cars on the road at different times during the day. It is of importance, therefore, to adapt the number of cars to the travel and to increase the per cent. of paying load.

Conclusion.—The purpose of this article is to furnish some empirical data of the performance of some electric cars under certain conditions, and the tables have been made as explicit and yet condensed as seemed feasible, in order to enable those who are interested in the subject to obtain such information as they desire. It did not seem advisable to present the data in a digested form, owing to the limitations that would result from any one person drawing conclusions for others who may be interested in diverse phases of the subject. The data affords opportunity for deductions along such a variety of lines that it would take a greater amount of time and space to work them out than is available at present, and many of the uses to which it might be put cannot be anticipated. Some conclusions were, however, given in connection with the results where it seemed well to do so.

When data is picked out from the tables or diagrams, care should be taken to note the conditions, especially the grade and speed, which have such an important effect upon the amount of energy required to operate the car. The values should have been reduced to unit grade and unit speed, that more correct comparisons might be made, but no feasible way presented itself, as the relation between these quantities is not constant and no curves expressing the variable ratio are available. The attempt has been made by some writers to express the energy required by a car, in terms of unit speed, by dividing the watt-hours per car-mile or per ton by the speed in miles per hour, but as the watt-hours do not vary in a constant ratio with the speed, except within very small limits, this method is erroneous.

Incomplete as most of the data is in many of the directions toward which these tests were aimed, it was deemed advisable to furnish at least part of what little had been obtained in case some of it might prove useful at present, and with the hope that it might excite interest in further and more thorough research along many of the lines in which empirical data of the performance of electric cars is greatly needed.

Lastly, the author desires gratefully to acknowledge the kindness and labors of the many persons who assisted in the tests and their compilation, and without whom it would have been impossible to complete the work.

The officials of the railway companies who afforded the opportunities of making the tests and to whose courtesy, interest and liberality the extent of the work is mainly due.

The students in the electrical course who assisted in taking the observations, for their careful and accurate work in making the measurements.

Messrs. Francis Head and Harold M. Dyar, former colleagues, whose invaluable assistance rendered the first tests possible.

Mr. Wallace D. White, a former student, whose careful draughting of the diagrams and tables was of a most valuable character in assisting in their accurate reproduction.

Dr. Louis Duncan and Mr. Carl Hering for many valuable criticisms and suggestions.

The engineering staff of the Westinghouse Electric & Manufacturing Company and of the General Electric Company for helpful suggestions and the loan of diagrams and instruments.

The editors of the Electric Railway Gazette, to whose painstaking efforts the very creditable production and arrangement of the matter composing this article is mainly due.

St. Louis Street Railway Convention.

Representatives of the street railway companies of St. Louis met at the Mercantile Club in that city last week to form an organization to take charge of the arrangements for the next convention of the American Street Railway Association in St. Louis next October. Robert McCulloch, vice-president and general manager of the Hamilton syndicate, was elected president; Harry Scullin, vice-president and general manager of the Union Depot Railway Company, vice-president, and Robert Lehmann, secretary of the St. Louis & Suburban Railway Company, secretary and treasurer; P. C. Maffitt, president of the Missouri Railway Company; George W. Baumhoff, general manager of the Lindell line, and Joseph S. Minary, general manager of the Southern Electric line, compose the executive committee, with the president *ex-officio* chairman. The committee was empowered to appoint all the sub-committees it deems necessary.

To Construct a Bicycle Railway.

The Kings, Queens & Suffolk Railway Company has petitioned the State Board of Railway Commissioners for permission to construct a railway through Long Island. The proposed road is to be built in accordance with the Boynton electric bicycle railway system. It is proposed to construct the line from the present terminus of the Kings County Elevated road in Brooklyn to Far Rockaway, and the projectors claim that the company has at present a bona fide capital of $200,000, and a promise of sufficient money to make the construction of the road certain. The company has already operated an experimental road at Bellport, L. I., the operation of which is claimed to have been successful in all respects, and it is stated that high speeds were attained. The Long Island Railway Company opposes the construction of the new road.

Telephone in Trolley Systems.

The Hartford Street Railway Company will construct a telephone system in order that conductors on suburban lines may communicate with the car despatcher in the case of accident or delay. The telephone wire will be strung on the trolley poles with suitable contacts on every eighth pole. Each car will be provided with a transmitter and receiver, which may be conveniently attached to the contacts, and communication thus established. It is expected that the device will obviate blockades and delays in switching and kindred troubles. Mr. W. C. Fielding, of Hartford, has purchased the system.

Rail Bonds.

In reference to the question of rail bonds concerning which an inquiry was recently made of the General Electric Company the Supply Department furnishes the following information:

"For the past two years it has not been the policy of our company to furnish either iron or copper rail bonds. We did at one time furnish galvanized iron rail bonds, in several sizes, but as they did not prove altogether satisfactory they were abandoned as an article of sale by us. Since the subject of proper track bonding has been prominently before the attention of railway engineers the General Electric Company has advocated the use of channel pins in connection with copper wire for bonding rails. We have made exhaustive tests and trials on different types and sizes of channel pins, and are confident that we have at this time a channel pin which is as near perfection as can be obtained. During the year 1895 we have sold over 800,000 channel pins, enough to bond 1250 miles of track, to railway companies, not only in the United States and Canada, but all over Europe and South America. Our present pins are made in two sizes, 19-32 inch and 3-8 inch.

"If rails are properly drilled and channel pins selected to correspond, there is no reason why a perfect and tight contact cannot be made with a copper bond and channel pin. Rails may be drilled at any point, and bonds run to any position on the opposite rail or track. Made-up rail bonds, to be used for the same purpose, are very expensive. In bonding around the ends of rails any number of copper bonds can be placed in connection with channel pins. They are easily inserted, and, if properly driven in the rail, make a perfect contact between the copper bond-wire and rail."

Portland Transmission Plant.

In the description of the long-distance power transmission plant at Portland, Ore., which appeared in the Gazette of Oct. 12, an error occurred in the description. It was stated that "the four-wire system is worked at 1000 volts between wires and by means of feeder regulators a variation of 4 per cent. in either direction is covered." This should read: "The four-wire system is worked at 133 volts between any two wires, and by means of feeder regulators a variation of 7½ per cent. in either direction is covered."

Closed Conduit System to Be Installed in New York.

The Metropolitan Traction Company, of New York, is to make a test of the Johnson-Lundell closed conduit system. A section of track is to be equipped at the foot of Thirty-fourth Street. F. S. Pearson is authority for the statement that in all probability five or six miles of track will be equipped eventually with this system in order that its merits may be thoroughly tested.

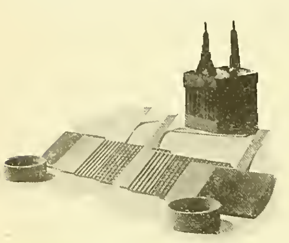
Electric Mail Car for Cincinnati.

Assistant Superintendent Martin, of the Railway Mail Service, while recently in Cincinnati, made an arrangement with Postmaster Brown and President Kilgore, of the Cincinnati Street Railway Company, for the operation of an electric mail car, and it will appear on the streets in the near future.

Hatch Storage Battery.

The mechanical weakness of the lead peroxide sulphuric acid accumulator has been the feature which has prevented its universal application. The active material, peroxide of lead, must be held in intimate contact with the electrodes, and sufficient space must be left between the latter for the acid solution. In order that the cell may have low resistance, it is imperatively necessary that the plates be near together. Up to the present, the support for the active material has ordinarily been the plate itself, which was peculiarly shaped for the purpose. This is called the grid form, and all patents covering this type of accumulator are now in the possession of one company.

The particular feature of the Hatch storage battery is its mechanical construction, and it is claimed the design gives sufficient strength to the structure while materially diminishing the weight. The battery also has the advantage that the ordinary plate sheet lead may be used, thus involving a minimum cost of manufacture. The construction of the cell is very ingenious. The support for the peroxide paste consists of a peculiarly shaped piece of porous earthenware. It is fluted on one side and on the other is cross-fluted, thus dividing it into a number of little square cavities. The plate is light, thin and extremely porous; so porous, in fact, that it is impossible to wet one side and turn the plate over before the water has soaked through. The peroxide paste is applied to the side with the square cavities, completely filling them and covering the plate to a thickness of one eighth of an inch. Two such plates are applied to each side of an ordinary sheet lead electrode, and when the cell is properly formed the oxide agglomerates with the lead, so that it is hardly possible to detect where the active material ends and the lead begins. Two plates carrying these pottery grids are placed side by side, so that the flutes on the outside of the grids cross, and thus the cell is built up to the capacity desired. A complete element having been formed, alternate plates are placed in electrical connection, and the whole mass is secured by rubber bands. These permit of expansion and contraction during charge and discharge.



COMPLETE BATTERY AND PARTS.

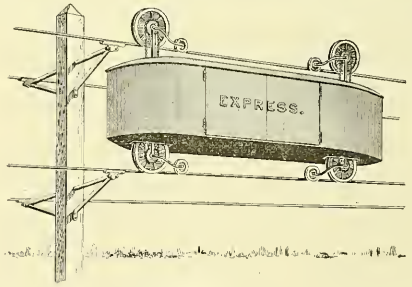
This method securely locks the active material in contact with its electrodes in such a manner that it cannot fall out. The cell is said to be remarkably durable. Two small cells were short circuited in the presence of the writer through an ammeter, which indicated steadily a current of 50 amperes. So confident are the manufacturers that they issue no special directions with regard to short circuiting. Any rate of discharge is permissible, though, of course, there is a normal rate that gives most efficient results.

A general view of the battery is shown in the illustration, including the complete element and the parts without the active material. The utility of a good storage battery is well recognized, and the Hatch Storage Battery Company, of Philadelphia, believes that its cell is not only adapted for general kinds of work, but is especially calculated to perform good service for street-car traction.

Electric Delivery System.

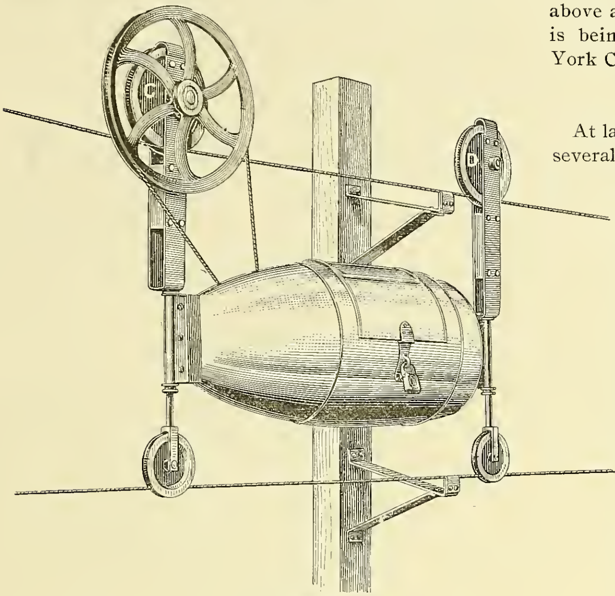
The system of transporting express mail and express matter which the Electric Express & Transportation Company, of New York, is presenting to the public is interesting and worthy of consideration. The system is simple and not entirely new, although no one appears to have designed to apply it in the precise manner that the company proposes. Electric railway companies already have two of the three essentials necessary for the introduction of the system. They have power at 500 volts, and the pole line and right of way. They require merely the equipments, which the above company is ready to furnish.

The illustrations give a general idea of the system. To each of the poles one or more brackets are attached, in the manner shown in the cuts. A small car travels on upper and lower cables which are carried by the brackets, its weight being divided between the two wires. The current is furnished by the upper wire and returns through the lower. The current passes through a 2-hp motor, which, by chains or belts, as represented in the figures, revolves the supporting wheels and propels the car. The car is built of extremely light material, and is carefully shaped so as to present the minimum resistance to the air. With the present models a speed of 20 miles an hour has been readily attained, and of course any less speed is practicable. The three figures show types of cars designed to meet different conditions of tarffic. Generally speaking, only mail and express matter will be carried aboard the car, and the system is intended entirely for local lines. Should it be deemed necessary to have an attendant accompany the mail cars, he can be accommodated, as shown in one of the illustrations.



EXPESS CAR.

The practical operation of the system is authorized by the company, as follows: A main depot, which may be designated as *A*, is arranged in the business centre of a city, and from this point lines diverge in various directions, with branches, leaving the latter if desired. Other stations, such as *B*, *C*, *D*, are located in the suburbs, or at the junctions of branch lines. All these stations have telephonic or other means of communication. All packages or mail matter are brought to the various stations with their destination marked upon them. For each package a small charge is made proportionate to its bulk-weight or the distance which it is to be carried, as the management may determine. To illustrate the working of the system, suppose that a car starts from station *A* with packages consigned to stations *C* and *D*. At *C* packages are to be carried to both *D* and *B*. The operator at the central office, *A*, notifies *C*, either by bell or telephone, that a car has started. It passes by *B*, for no packages are to be delivered there. *C*, however, opens a switch, interposing a dead section on the line, and the car comes to a standstill at his station.



EXPRESS CAR.

He opens the car and removes the packages intended for his station. He would have stopped the car in any event, for he had packages for the station beyond. He now puts these latter aboard, and, starting the car, warns *D* to that effect, who similarly stops it, takes out his packages and starts it onward. *C* in the mean time has stopped the first car going in the opposite direction toward *A*, put his packages for *B* aboard and notified *B*. When this plan is followed no car stops uselessly, and as the lines are clear there is no delay and matter is much more rapidly distributed than is possible by street-car service. In short, the extreme flexibility of the system allows great diversity in methods of management.

The operator at station *A* is supposed to be responsible for the general working of the system. He will keep accounts and collect the money from the sub-stations. The sub-station operators may be boys of 17 or 18 years, and their wages will be comparatively small.

The system is designed to take the place of delivery by light express wagons as well as to carry mails. The estimated cost of construction complete is $2500 per mile. The company has made calculations of probable receipts and expenditures which seem very conservative, and on this basis a profit of over 50 per cent. above all operating expenses is figured out. The system is being introduced by Mr. S. Cady Hutchins, of New York City.

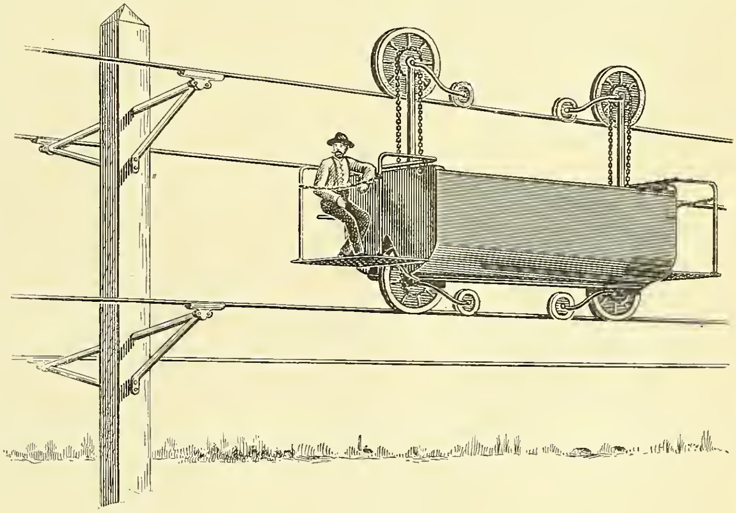
Electricity on the Brooklyn Bridge.

At last week's meeting of the Brooklyn Bridge trustees several bids were received in response to the advertisements for proposals for the construction of the electric system for switching the trains in the terminal stations and for heating the cars by electricity. It was decided that as several irregularities were discovered in the bids they should be returned to the companies for correction and the bids will be opened at the next meeting. The October report, which was submitted, showed that the traffic on the bridge was increasing. During October 3,909,133 passengers were transported, or a daily average of 126,101. This was an increase of 8596 in the daily average of passengers compared with the number for the previous month.

At the meeting this week bids for an electric switching system were submitted by the Westinghouse Electric, the General Electric and the Enholm Conduit & Trolley Companies. Chief Engineer Martin said that the plan submitted by these three bidders were so widely different that it was impossible to form any accurate idea of their comparative values. The Executive Committee, therefore, recommended that the offers made by the Westinghouse and General Electric companies each to equip a train with their systems for a thirty-day test be accepted.

New Brooklyn Company.

The East River & Atlantic Avenue Railway Company, of Brooklyn, has been incorporated with a capital of $3,000,000, and it has applied for a franchise over thirty miles of streets. The incorporators are the directors of the Nassau Electric Company.



MAIL CAR.

FINANCIAL NOTES.

NORTH SHORE TRACTION EARNINGS.—The North Shore Traction Company reports a net increase in earnings for September of $29,271, and for the fiscal year ending Sept. 30, a net increase of $104,891.

RICHMOND TRACTION COMPANY LOAN NEGOTIATED.—The Richmond (Va.) Traction Company has negotiated a loan of $500,000 in Baltimore to complete the construction of its rapid transit system in Richmond.

METROPOLITAN AND BALTIMORE TRACTION EARNINGS.—For the first 18 days of November the Metropolitan Traction Company reports $76,086 increased earnings over the corresponding period of last year, and the Baltimore Traction Company $7600 increase for the same time.

DETROIT RAILWAY MORTGAGE FILED.—The Detroit Railway has filed a trust mortgage with the Cleveland Trust Company, of Cleveland, for $1,800,000 to secure an issue of bonds to that amount, which will be made at once. The capital stock of the Detroit railway is $1,000,000, and $1,700,000 has been spent equipping the system.

STOCK AND BOND ISSUE AUTHORIZED.—The Railway Commissioners have authorized the Interstate Consolidated Street Railway Company to issue stock and bonds to the amount of $317,000, for the purpose of acquiring railways and other properties in Attleboro, North Attleboro, Wrentham and Seekonk, Mass. For the purpose of providing for necessary improvements and additions now in progress or contemplated, an additional amount of $62,800 is authorized, making the total present issue $380,000, of which $230,000 shall be stock and $150,000 bonds.

WEST END STREET RAILWAY EARNINGS.—The West End Street Railway Company, Boston, reports for the year ended Sept. 30 an increase in gross earnings of $922,291.68; an increase in operating expenses of $826,080.09; and an increase in net earnings of $96,211.59. After deducting taxes and bad debts charged off, fixed charges, etc., there is left $1,143,221.33 which is $40,696.33 more than the dividend charges, and therefore represents net surplus.

LONG ISLAND TRACTION COMPANY TO BE SOLD.—The property of the Long Island Traction Company will be sold under a decree of foreclosure on Dec. 5. It is reported that a new company will be organized with a capital stock amounting to $20,000,000, and $7,000,000 5 per cent. bonds, it is said, will be issued. Ex-Gov. Flower, A. N. Brady and F. P. Olcott will constitute a voting trust for five years. Long Island Traction stock and Brooklyn City Railway are inclined to be weak, and very little trading in the latter stock has taken place.

MILWAUKEE STREET RAILWAY TO BE REORGANIZED.—The Milwaukee Street Railway Company's property will be sold to the highest bidder within three months—probably shortly after the first of the new year—and will then be reorganized and operated by a new and strong company, consisting of Eastern capitalists. This much is learned officially as the result of a visit to the city of George R. Sheldon, receiver, and C. A. Wetmore, president of the North American Company, which has been very largely interested in Milwaukee securities, and especially street railway property. While these gentlemen will not talk for publication upon the subject of reorganization, it is learned from the best sources that the wind-up of the receivership is now very close at hand, and that a new company will soon be in charge.

NEW INCORPORATIONS.

BEATRICE, NEB.—The Beatrice Electric Company, capital stock $100,000, has been incorporated by John F. Horback, Paul W. Horback, Victor C. Lantry, John E. Smith and Albert S. Maxwell, for the purpose of operating street railways, gas, electric light, heat and power plants.

ALBANY, N. Y.—The Albany, Helderberg & Schoharie Electric Railway Company has been incorporated by J. W. Van Valkenburgh, J. H. Brooks and B. M. Secor, Albany, N. Y., to construct and operate an electric railway in Albany and Schoharie Counties. Capital stock $300,000.

NEW YORK CITY, N. Y.—The Johnson-Lundell Electric Company has been formed, with a capital stock of $500,000, for the purpose of dealing in dynamos, motors, railway apparatus, etc. Those interested are F. H. Benedict, E. H. Johnson, Robert Lundell and F. S. S. Hastings, New York City.

ST. JOSEPH, MO.—The St. Joseph Railway, Light, Heat & Power Company, capital stock, $3,500,000, has been formed by W. T. Van Brunt, R. A. Brown and J. H. Van Brunt, St. Joseph, Mo., and W. M. Harriman, New York City, for the purpose of constructing street railways and furnishing light, heat and power.

CLEVELAND, O.—The Lorain & Cleveland Railway Company, capital stock, $500,000, has been incorporated by B. Mahler, E. W. Moore, E. C. Tillotson, S. H. Short and J. B. Hoge, for the purpose of constructing, operating and maintaining an electric railway between Lorain and Cleveland; also for generating and selling electricity for light, heat and power.

NEWS OF THE WEEK.

REYNOLDSVILLE, PA.—It is reported that an electric railway will be built between this place and Rathine, three miles distant.

BEVERLY, MASS.—It is reported that the Beverly & Danvers Railway is to be equipped with the overhead system of electricity.

PLATTSBURG, N. Y.—The work of surveying a route for the proposed electric railway has been commenced by Civil Engineer W. H. Stair.

DOWNSVILLE, N. Y.—W. F. Randall, of Syracuse, has laid out the route of the proposed electric road between Syracuse and East Branch.

EDGEFIELD, S. C.—The extension of the electric road from the North Augusta Bridge through Edgefield to the court house is contemplated.

BANGOR, ME.—The Bangor, Orono & Oldtown Street Railway Company has applied for right of way to construct and operate a street railway in State Street.

BURLINGTON, VT.—The Winooski & Burlington Street Railway Company has been granted a franchise to extend its lines through the northwestern part of this city.

NIAGARA FALLS, N. Y.—A second petition has been presented to the Council by the Niagara Falls Street Railway Company for a franchise to build a line on Niagara Street.

WEST HOBOKEN, N. J.—A meeting of the citizens was recently held to discuss plans for a trolley line through Main Street, which is very greatly desired by the residents in this vicinity.

CICERO, ILL.—The Ogden Street Railway Company has presented a petition to the Town Board asking for a franchise for an electric line on Ridgeland and Stanley Avenues to the west line of Cicero.

SPRINGFIELD, MASS.—The Board of Aldermen has granted the street railway company the right to lay a double track road from the Ingleside turnout to the city line on the West Springfield road.

BERLIN, CONN.—It is said that a number of citizens of East Berlin are anxious to persuade the Middletown Railway Company to extend its line to connect with the Central Railway & Electric Company.

BOSTON, MASS.—It is reported that the New York, New Haven & Hartford Railway Company will build a power-house and repair shops at South Braintree for the proposed electric road between that place and Boston.

MEADVILLE, PA.—At recent separate and joint sessions of both branches of the City Council action was taken which indicates that a speedy and equitable settlement of the street railway question will be arrived at and a franchise granted.

AKRON, O.—At 4 o'clock on last Saturday afternoon a solid silver spike, the last one in the Akron, Bedford & Cleveland Electric Railway, was driven by Charles Howland, of the company. This completes what is said to be the longest suburban electric road in the world.

OTTAWA, ONT.—Application is being made for the incorporation of the Canada Electric Railway & Power Company to build an electric railway from Montreal to Windsor, Ont., via Brockville, Kingston, Belleville, Toronto and London, with power to build branch lines to Suspension Bridge and elsewhere.

NEWARK, N. J.—Mayor Harrison, of Caldwell borough, has vetoed the ordinance passed by the Council granting a franchise to the North Jersey Street Railway Company for a trolley road on Bloomfield Avenue. It is said by members of the Council that the franchise will be passed over the veto at the next regular meeting.

ECORSE, MICH.—The Township Board of Ecorse has granted a franchise to the Ecorse Electric Company for constructing and operating for a term of 30 years an electric street railway through the town. Hyacinth C. Burke, of River Rouge, P. O., and Charles W. O'Brien, 77 Moffat Building, Detroit, Mich., are at the front of the project.

BRADFORD, PA.—A company has been formed for the purpose of building a trolley road on Congress Street, from Main Street to Thompson Avenue on Mechanic Street, to Washington Street, to School Street, and on Main Street from Mechanic Street to Congress Street. Capital stock has all been subscribed and all details of organization perfected.

AKRON, O.—The Akron & Cuyahoga Falls Rapid Transit Company and the Akron & Cleveland Electric Railway Company have been amalgamated, and a road will be built from Akron to Cleveland under franchises which were secured two years ago by the latter company, but have lain idle ever since. Among those interested are C. F. Dunbar, F. M. Chandler and F. M. Wilcox, of Cleveland.

FULTON, N. Y.—The Oswego Falls & Fulton Street Railway has changed hands and will be converted into an electric road and extended through the principal streets of this village and Oswego Falls, to the city of Oswego. The name of the road will be changed to the Riverside Electric Railway. Among those interested are Lawrence Clancy, George N. Burt, George D. Hart and Charles H. Tanner.

ELIZABETH, N. J.—The Consolidated Traction Company has purchased valuable wharf property at Elizabethport, to be used as a terminal of the New Jersey system of the trolley lines in this section of the State, and will connect by means of a ferry across Staten Island Sound with the trolley system on Staten Island, which comprises about 25 miles of road along the shore to St. George and South Beach.

QUEBEC, ONT.—Canadian capitalists are interesting themselves in the project of an electric street railway in Buenos Ayres, Argentine Republic. The city has 750,000 inhabitants, and there are only two streets in which the electric company has not the right to lay down tracks. The matter has been brought to the attention of the capitalists by J. Arthur Maguire, Consul-General here for the Argentine Republic, and several men of wealth, who, apparently, have not sufficient confidence in the future of their own country to invest their money here, are joining the promoters of the Buenos Ayres railway.

BENNINGTON, VT.—The Bennington & Woodford Electric Railway Company has modified its plans respecting a pleasure terminus in Glastenbury, nine miles east of Bennington. The plan is now to convert the old hotel at Glastenbury into a casino and the abandoned steam sawmill of the Bennington & Glastenbury railway into a dancing pavilion. The casino, four miles east of Bennington, was so liberally patronized last season that the company is encouraged to go further into the mountains, hoping that the longer ride and added attractions will prove financially successful. Some of the work of constructing the road from Camp Comfort to Glastenbury, four miles, will be done this season.

WASHINGTON, D. C.—The Metropolitan Railway Company has purchased a site for its new power-house. The ground lies between East Capitol and A Streets, and Fourteenth and Fifteenth Streets, S. E. The building is to be a handsome structure, according to present plans, and an ornament, architecturally and otherwise, to that section of the city. The entrance for the cars will be from the Fifteenth Street side, to avoid crossing the East Capitol Street parking, and the front on the last mentioned thoroughfare will be elaborately ornamented. It is the understanding that the building will be three or four stories in height. Work upon it is to be commenced at once.

PHILADELPHIA, PA.—On Tuesday General Division Superintendents Whiting and Ellis, of the Union Traction Company, took charge of the two general divisions into which the Philadelphia Traction Company's system of roads has been divided for the purpose of operation. The Union Traction Company's big system has been divided by General Manager Beetem into four divisions, two of which comprise the Philadelphia Traction Company's roads. The other divisions are the People's, composing the old People's system, Harry Miller, general superintendent, and the Electric Division, comprising the Electric Traction lines, C. C. Benson, superintendent. Messrs. Miller and Benson took charge early in the month, so that the Union Traction now has absolute direction of the operation of its entire system.

DETROIT, MICH.—Tom L. Johnson, president of the Citizens' Street Railway Company, has delivered to Mayor Pingree the company's ultimatum. Unless it is given needed extensions without fighting for them it will withdraw transfers where not called for by ordinance and will charge a straight 5-cent fare, doing away with the six-for-a-quarter tickets. Mayor Pingree and Mr. Johnson had a long conversation over the matter on Monday and the latter says while the company has fulfilled every promise it made as to equipping its lines with electricity, it is hampered by the Mayor and the Council at every point. Mayor Pingree is chary about giving out his views of the ultimatum. This city for five years has been the centre of a street-car war, and with two such fighters as Mayor Pingree and President Johnson going it is apt to remain a battlefield for years to come.

PITTSBURG, PA.—The Homestead & Highland Street Railway will be double-tracked between Homestead and Oakland. A force of nearly 100 men have already been placed at work. It is expected that work will be completed by the last of this month. When this is completed the company expects to make a deal with the Duquesne people and run cars into the downtown district. The Fort Pitt Street Railway Company has begun pushing the work in the laying of tracks on Liberty Street from Sixteenth Street, to join the portion already laid as far as Bloomfield, and it will be shoved along rapidly. The frogs for connecting with the Allegheny Traction Company's tracks are in position, and the rails are laid out on the route. The connection at Liberty and Centre Avenues is completed. The Second Avenue Electric Traction Company has made a reduction in fares from Turtle Creek to this city since the line was opened up to that borough. The fare, beginning last week, will be 15 cents each way. From Turtle Creek to Rankin, a distance of four miles, the fare will be 5 cents. Heretofore the fare was 5 cents from East Pittsburg to Braddock, and another fare from Braddock to Rankin. The rates were reduced to secure the patronage of workingmen east of Braddock who are employed in the Rankin Mills. This was a voluntary reduction on the part of the company.

TRADE NOTES.

THE CHESLEY ELECTRIC COMPANY, whose repair shops are located at 601–605 Newark Street, Hoboken, N. J., has established a New York office in the Havemeyer Building, in charge of Mr. W. J. Johnson. The Chesley Company's shops are kept very busy with repair work, so much so that it has been necessary to recently add some heavy machine tools to the company's equipment. The company makes a specialty of heavy electric railway repairs, and has issued an interesting circular describing its work.

THE ABENDROTH & ROOT boilers, installed in the municipal electric light plant, at Hamilton, O., have called forth high praise from all engineers who have inspected them, and the Hamilton *Daily Republican* comments upon the plant as follows: "The electric light committee is to be congratulated upon its selection of these boilers for the city's new electric light plant. In doing so it has acted in accordance with the judgment of the best engineers of this city." These boilers are meeting with the same sort of commendation in street railway circles.

THE CENTRAL MANUFACTURING COMPANY, of Chattanooga, Tenn., is making a specialty of cross-arms, insulated pins and brackets, mouldings for wires and various other forms of wood-work used by electrical manufacturers and contractors, and carries a large line of such goods constantly in stock, so that emergency orders can be filled immediately upon their receipt. The quality of its product and prompt shipments have combined to put the Central Company in high favor with the general trade even in places remotely removed from its headquarters.

THE BISHOP GUTTA PERCHA COMPANY, New York, has just issued a new catalogue of its widely used product. An "insert" leaf is sent with the catalogue which contains some very pertinent and interesting information and advice concerning the kind of rubber used for insulating wires and cables. This significant statement is made: "The Bishop Gutta Percha Company has never used a pound of reclaimed rubber, and it doesn't intend to!" Bishop wires have established during their half century of existence a reputation which will surely endure, and users of this sterling product are to be found in every country in the world where insulated wires are known.

THE ELECTRICAL TRADES ASSOCIATION has just been organized in Philadelphia and incorporation papers have been applied for. The association has for its object the mutual advancement of the interests of manufacturers and jobbers of electrical supplies and apparatus, and is organized with very encouraging prospects, a number of representative electrical houses outside of Philadelphia having signified their intention of supporting the movement. The following officers were elected: C. E. Trump, president; C. M. Wilkins, vice-president; P. Logan Bockius, treasurer, and Richard Cadbury, secretary. The association's headquarters are at 735 Drexel Building, Philadelphia.

THE BALL ENGINE COMPANY, of Erie, Pa., has just published a large and finely executed catalogue which describes in detail, and with numerous illustrations, their well-known engines. Particular attention is called in the catalogue to the telescopic balanced valve and the governor mechanism which have contributed so largely to the success and popularity of the Ball engine. Illustrations are given of all of the many types of engines built by this company, including tandem and cross-compound engines, side crank and vertical engines and engines of various types direct-connected to generators. The catalogue is an unusually complete one and will undoubtedly be of value to street railway managers contemplating an increase in their steam plant or already operating Ball engines.

THE METROPOLITAN ELECTRIC COMPANY, 186–188 Fifth Avenue, Chicago, has issued a very comprehensive, handsomely executed catalogue of electrical supplies, which reflects great credit on President W. H. McKinlock, who arranged the book. The catalogue contains about 755 pages of printed matter, handsomely and profusely illustrated, describing the company's numerous specialties, among which are lighting arresters, switches, connectors, insulated wire, interior conduits for car wiring, line material and brackets, tools, etc. All receive careful attention, and their methods of use and operation are thoroughly explained. This book furnishes a very handy volume of reference for street railway men and others, showing at a glance the great improvements that have been made in electrical apparatus and appliances.

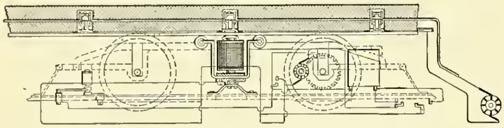
THE ITHACA DESK COMPANY of Ithaca, N. Y., has issued its maiden catalogue, which does it great credit. This company manufactures a full line of office desks of various types, but makes a specialty of roll-top construction, many forms of which are shown in the catalogue, including swinging-arm desks, combined swinging-arm and filing-cabinet desks, combined desks and letter files, low and high roll desks and typewriter cabinet desks. A new form of the latter class of furniture consists of a desk the typewriter cabinet of which is located at the top of the right-hand tier of drawers instead of being in the centre of the desk table. This construction obviously presents the advantage of enabling the user to open and close the typewriter portion of the desk without disarranging papers, etc., which may be lying on the table. Another special form is a double roll-curtain desk, the second roll-curtain being arranged to enclose a document-filing case which is placed on the top of the desk proper; the two roll-curtains are entirely independent of each other. All of the product of the Ithaca Desk Company is furnished in various woods and finished in the highest manner only.

THE AMERICAN SILK MANUFACTURING COMPANY, of Philadelphia, has been supplying the Electrical Department of the Atlanta Exposition with silk wipers since the opening day. The results which have attended their use are said to be highly satisfactory. Raw silk machinery wipers, while not new, have recently grown in favor until they are supplanting in many plants, especially in electrical stations, the old form of wipers. Some 15 years ago they were introduced in Vienna, Austria. No objection was made to the washing of the silk in Europe, but employees on this side of the Atlantic were prejudiced against washing the greasy wipers. To overcome this objection it was found necessary to devise a special compound for use with the wipers, which is not injurious to the wiper, and is economical and efficient in weak solutions, so that the work of cleaning is shortened and rendered easier, while the wiper does not accumulate so much grease and dirt, most of it being left in the solution for cleaning. These silk wipers can be washed and used again and again. They are devoid of the liability to spontaneous combustion, a danger which is always present with cotton waste. A number of years ago Mr. Felix Haac began the manufacture of raw silk machinery wipers in St. Louis, Mo., and the business has been developed by the American Silk Manufacturing Company, of 311 Walnut Street, Philadelphia, founded by Mr. Haac in 1887.

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED Nov. 12, 1895.

549,485. ELECTRIC LOCOMOTIVE; Francis B. Badt, Chicago, Ill., assignor to the Siemens & Halske Electric Company of America, same place. Filed Aug. 1, 1895. In an electrically propelled vehicle the system of two or more motors, one of which is connected by gears and used in starting, being thrown out when speed is attained and motors geared directly on the axle then coming into play.


NO. 549,580.—CONDUIT ELECTRIC RAILWAY.

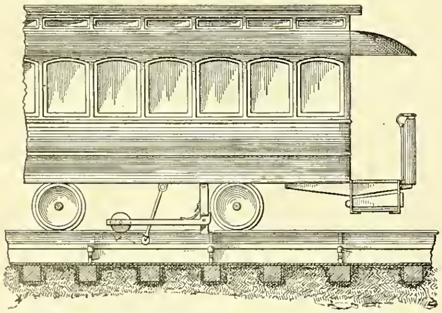
549,491. RAILWAY TELEPHONE SYSTEM; William H. Clewley, Providence, R. I., assignor to William H. Nixon, same place. Filed April 10, 1895. A system of wiring for telephonic communication, suitable connecting clips being provided at various locations, designed to be applied to street railways, each car being provided with a complete telephonic outfit for connecting, as indicated.

549,500. CAR FENDER; Levi Dederick, Albany, N. Y. Filed Oct. 11, 1894. A car fender with hook-shaped flat steel strips pivotally mounted on a bar at right angles to the tracks. Each strip is independent and is provided with a spring which automatically forces the strip against the roadbed when the fender strikes an obstruction.

549,518. CAR FENDER; James W. Madden, Brooklyn, N. Y. Filed Jan. 31, 1895. In a car fender a pair of triangular moving wings pivoted to the sides of the platform forming the fender proper and arranged by suitable levers which throw out sideways when the fender strikes an obstruction.

549,522. ELECTRIC MOTOR SYSTEM AND TRACTION DEVICE; Thomas P. Milligan, South Orange, N. J. Filed Jan. 26, 1895. A traction device running on a single girder rail, and propelled by two wheels pressing against the web thereof, with increasing force when the tractive effort is applied.

549,580. CONDUIT ELECTRIC RAILWAY SYSTEM; Byron E. Osborn, Auburn, N. Y. Filed July 14, 1894. An electric railway system of sectional conductors with magnetic contacts. Each sectional conductor carries pendant armatures which make contact and are operated by a powerful magnet aboard the car. Suitable collectors impinge on the rail during the period in which it supplies current. (See Illustration.)

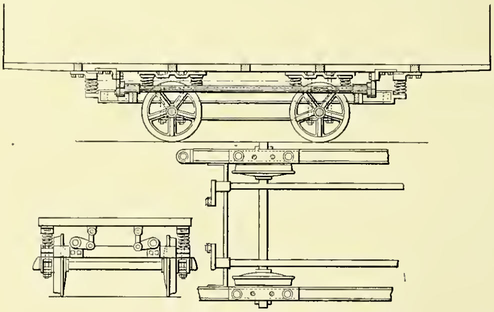

NO. 549,652.—UNDERGROUND ELECTRIC PROPULSION.

549,598. ELECTRIC CONTROLLER; Jonathan P. B. Fiske, Alliance, O. Filed Feb. 13, 1895. An electric controller comprising a flat resistance coil spirally wound, two sets of contact points on the flat surfaces thereof, and a lever pivoted to swing onto either side. The lever as it swings operates by a cam movement a reversing switch.

549,608. ELECTRIC CONTROLLER; William H. Morgan, Alliance, O. Filed Aug. 22, 1895. An electric controller composed of two castings in the form of an oblate spheroid, enclosing an annular shaped resistance provided with suitable contact plates. The controller is operated by a rotating frame within a shell pivotally mounted on the axis of symmetry, and is driven by a pinion meshing with a swinging segment to which a handle is affixed. The shaft also carries an insulating block on which are mounted reverse contacts.

549,652. UNDERGROUND ELECTRIC PROPULSION; John E. Parker, New York, N. Y. Filed June 23, 1894. A rectangular iron conduit, a flat conductor supported in its centre, and suitable cleaning brushes carried by the car. (See Illustration.)

549,655. CONTACT DEVICE FOR ELECTRIC RAILWAYS; Constantin A. Philipsborn, Berlin, Germany, assignor, by mesne assignments, to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed April 20, 1893. A contact device whereby a rectangular frame is pivotally mounted on two supports which have balanced spring suspension after the manner of the ordinary trolley. The two supports are made to approach each other by a spring which forces two shoes on the rectangular frame into contact with one or more wires. The rectangular frame is normally held in line with the supports by two spiral springs.


NO 549,763.—STREET CAR EQUALIZER

549,762. RAIL CLAMP; Richard Blickenderfer, Lancaster, Pa., assignor to the Standard Guard-Rail Fastener Company, same place. Filed Aug. 14, 1895. A rail-clamp whereby two rails are secured by a claw and two adjustable separator blocks, wedge-shaped, the wedged surfaces being provided with teeth to prevent slipping.

549,763. STREET CAR EQUALIZER; James O. Brown, Boston, Mass., assignor to himself and Josiah Quincy, same place, and John R. Graham, Quincy, Mass., trustees. Filed June 27, 1895. An equalizing device to prevent teetering, consisting of two rock shafts connected to the body of the car by a link and crank. The rock shafts are parallel to the car body, and rigidly fastened to the truck to compel the parallelism of the car to the truck in a longitudinal direction. (See Illustration.)

549,787. STREET CAR TRUCK; William E. Haycox, Cleveland, O. Filed Oct. 15, 1894. A car truck with integral side pieces complete with pedestal jaws and supporting lugs and improved methods of bracing the spring suspension.

549,788. CAR BOLSTER; Martin K. Hench, Carlisle, Pa., assignor of one half to L. F. Bower, same place. Filed Oct. 16, 1894. A hollow pressed steel car bolster with depressions for the sills provided near the ends and suitably braced.

549,857. CAR BRAKE; Louis P. Pyott, Philadelphia, Pa., assignor of one half to Austen W. Goodell and Daniel A. Waters, same place. Filed May 31, 1895. A car brake in which the brake chain operates a lever and by a cam pivoted on the same shaft raises the knuckle of a toggle joint, wedging the brake shoes between the wheels.

Electric Railway Gazette.

Vol. XIII. NEW YORK, NOVEMBER 30, 1895. No. 22

A Modern Street-Railway Repair Shop.

The extensive repair shop of the Consolidated Traction Company, of New Jersey, now in course of construction, is rapidly nearing completion, and when finished will be one of the largest and most complete in the country. The building, which is located on Ferry Street, Newark, on the line of the company's Newark & New York division, will be devoted entirely to the electrical and mechanical repair work necessary on the extensive system operated by the company.

The building, Fig. 1, is interesting from a structural standpoint, as well as on account of the purpose to which it will be devoted. The dimensions of the structure are 120 feet in width, and 190 feet in length. The frame is entirely of iron and steel, which was supplied by the Pennsylvania Steel Company, and the walls are of brick. The roof is supported on steel trusses, which extends the full width of the building, and have a clear span of 120 feet. A ventilator in the roof extends the entire length of the building, and is provided with swinging sashes, which are operated from the floor below.

In many of the repair shops and car houses the tracks entering the building are directly connected to the main line tracks by switches. This arrangement is costly on account of the special work necessary, and is the cause of considerable complaint from passengers, on account of the jarring of the cars in passing over the numerous switches. These objections have been overcome by arranging the tracks leading to the several departments of the repair shop parallel to the main line tracks and providing a transfer table on which the cars can be quickly and easily shifted to any of the tracks. With this arrangement only one switch connection with the main line is necessary. The transfer table, shown in Fig. 2, runs on four T-rails, and is of sufficient length to accommodate the long double-track cars operated on the company's Newark & New York divison. The table is operated by a single reduction railway motor mounted upon the platform. The current for operating this motor is taken from a trolley wire which extends the entire length of the transfer-table tracks. Overhead wires also extend to the various departments of the building, and are so arranged that the cars can run on or off the transfer table by their own motors. There are 13 tracks entering the building, with a total capacity of 45 cars.

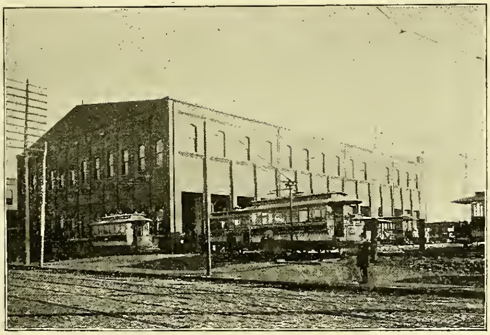


FIG. 1.—EXTERIOR OF SHOPS.

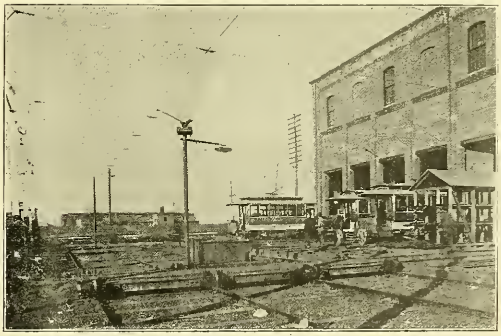


FIG. 2.—SHOWING TRANSFER TABLE.

The interior arrangements of the building are excellent. The motor repair shop and the carpenter, paint and blacksmith shops are located on the ground floor. The motor repair shop is equipped with the latest types of machine tools for making all necessary repairs. The power for operating the machinery is furnished by a single-reduction railway motor. Eight of the tracks in the motor repair shop are provided with pits of concrete and brick, for the inspection and removal of motors and armatures. The armatures and motors are quickly removed from the truck by a specially designed motor lift, as shown in Fig. 3.

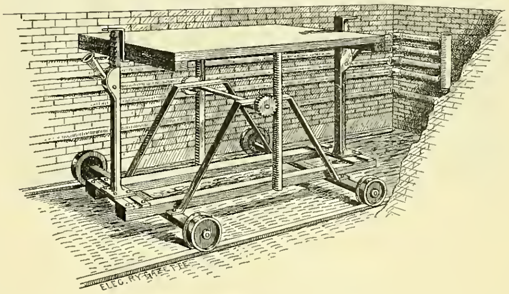


FIG. 3.—PIT ELEVATOR.

The blacksmith shop adjoins the motor repair shop and is provided with five forges. Air for the fires is furnished by a Buffalo forge blower, which is operated by a double-reduction railway motor. The shop is also equipped with an electrically operated high-pressure blower for cleaning controllers. Pipes lead from the blower to all of the tracks, and flexible connections are provided so that controllers can be easily and quickly cleaned.

The carpenter shop, shown in Fig. 4, is located in the east side of the building and measures 50 x 140 feet. The machine equipment consists of planers, shapers, mortising machines, band and circular saws—in fact, everything that is required in making any repairs to car bodies. All of the machinery is operated by electric motors. The paint shop is also located on the ground floor, in the south end of the building, and is provided with track connection to the transfer table.

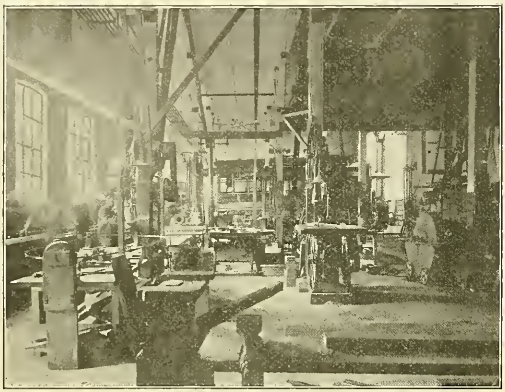


FIG. 4.—CARPENTER SHOP.

The motor repair shop is provided with an electric elevator for delivering armature and motors to the machine shops and armature-winding department on the second floor of the building. The machine shop is complete in every respect, and occupies the greater part of west half of the second floor. The equipment consists of the most modern types of machine tools and appliances, all of which are operated by electric motors. Light is furnished by large windows on three sides of the room. The armature winding is done in the north end of the room. Ample light for this work is afforded by large windows on the end and side of the room. The department is equipped with an armature dryer capable of accommodating 15 armatures. It consists of a double walled sheet-iron box about 12 feet in length and 5 feet in width. The walls are filled with sand, and heat is furnished by an ordinary car stove.

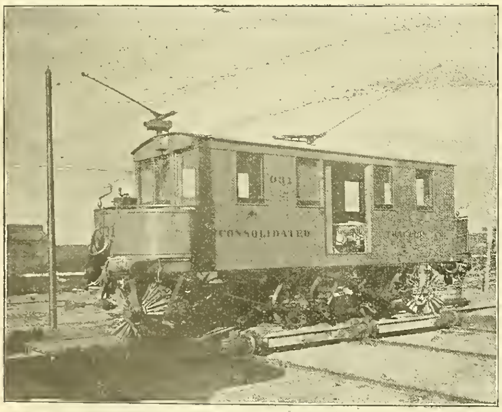


FIG 5.—SNOW SWEEPER.

The entire eastern half of the second floor is used as a storeroom, from which the supplies for the whole system are distributed. For facilitating the handling of the supplies a 15-ton electric elevator has been installed. The company owns several freight cars, on which supplies are transported from the storeroom to the various car houses.

The current for operating the motors in the different departments is supplied by a special feeder from the company's main power station in River Street, Newark.

A complete hot water heating system is now being installed. The boiler is of the Manning vertical type, and heating pipes will extend through the car house adjoining, as well as the various departments of the repair shop.

In Fig. 5 is shown one of 20 new electric snow sweepers recently purchased by the Consolidated Company, while grinding machines and wheel presses will shortly be installed, making the equipment complete in every respect.

The company operates in all about 600 cars, and the necessity for a thoroughly equipped machine shop, such as has been established, is obvious.

The National Electrical Exposition Company.

The National Electrical Exposition Company has been organized for the purpose of holding an electrical exhibition in May next, under the auspices of and in connection with the nineteenth convention of the National Electric Light Association. The executive office of the company is at 136 Liberty Street, New York.

The officers of the company are: Harrison J. Smith, superintendent of the Edison Illuminating Company, of New York, president; William F. Weiss, vice-president of the New York Steam Company, vice-president, and George F. Porter, secretary and treasurer. The executive committee, which is the governing power of the company, is composed of H. J. Smith, C. O. Baker, Jr., R. B. Corey, H. L. Lufkin and E. F. Peck, and the board of directors consists of H. J. Smith, C. O. Baker, Jr., John A. Seely, R. B. Corey, W. A. Stadelman, H. H. Harrison, H. L. Lufkin, W. F. Weiss, J. W. Godfrey and E. F. Peck.

The stock has all been subscribed, and 10 per cent. of the capital paid into the hands of the treasurer. The New York Industrial Building, Forty-third Street and Lexington Avenue, has been secured for the exhibition hall. The building was constructed expressly for trade expositions; is electrically lighted, and has a spare steam plant of 300 hp.

Electric Mail Service in New Jersey.

It is probable that the Consolidated Traction Company, of Newark, will operate mail cars over its lines. The Postmaster-General recently communicated with the company, requesting it to furnish a map of its lines in order that it might be seen whether the use of cars would facilitate the carrying of the mail. It is probable that as soon as the matter of payment is arranged the cars will, to a great extent, supersede the mail wagons. The introduction of the new system will greatly facilitate the delivery of letters in Jersey City, Newark, Elizabeth, Paterson and a number of other towns.

W. Worth Bean Vindicated.

W. Worth Bean, of the St. Joseph & Benton Harbor Electric Railway of Benton Harbor, Mich., has been acquitted by a jury of the charge of intentionally shooting Alderman Shriver of that city, during a controversy growing out of the removal of certain tracks owned by Mr. Bean's company. The incident occurred in August last year, and created the utmost excitement in Benton Harbor. At the time reports were sent out by the press associations describing a formidable riot, and accusing Mr. Bean of shooting an alderman while in the discharge of his duty. An investigation showed that not only were the dispatches grossly exaggerated, but were unfair in every particular toward Mr. Bean. The facts were substantially as follows: An effort was made in the council to cause the electric railway company to remove tracks on one of the streets of the city. It appeared that without any authority two aldermen, with a gang of laborers, and a guard of policemen, proceeded to tear up the tracks at 4 o'clock on Sunday morning, Aug. 12. Mr. Bean had appealed to the Sheriff to protect his property, and at the latter's request he furnished him with a posse, composed of four men besides himself. A car with a deputy sheriff and the Bean party was run to the point where the laborers were removing the track. While the officer was ordering the men to desist, the gun which Mr. Bean carried was accidentally discharged, and Alderman Shriver was slightly wounded. Mr. Bean assured all parties that the discharge of the gun was an accident which he regretted, but the explanation was not accepted, and reports that a deliberate attempt had been made to shoot the city official were circulated. The matter was taken to the courts, and the trial took place last week. One of the local papers is responsible for the statement that "the trial will go down in history as one of the most hotly contested legal struggles that ever occurred in Michigan." The jury brought in the following verdict: "We find that the defendant is not guilty, and that the plaintiff is not entitled to any damages." Mr. Bean is to be congratulated on the verdict, although none of his friends doubted that he would be vindicated by an impartial jury.

W. WORTH BEAN.

Railway Employees in St. Louis.

In speaking of the men employed on the street railways of St. Louis the *Globe-Democrat* of that city says: "More men by many hundreds are now employed than in times gone by, so it is estimated that fully nine tenths of the employees are men who have entered service since rapid transit has been inaugurated. The hours now are correspondingly short, the work lighter and more acceptable, and the pay higher. This is an inducement which brings thousands to the office of the companies seeking positions. The managers, as a result, have plenty of material to choose from, and have formed an army of able-bodied and intelligent men. The rowdy element has been displaced altogether. The motorman, the gripman and the conductor of the present is a more respectable appearing and a more genteel man than the man of the fore or aft platform of ten years ago.

Overhead Feeder and Trolley Construction of the New Orleans Traction Co.—III.

BY W. NELSON SMITH, M. E.

(*Concluded.*)

The poles have already been described. They are set seven feet in the ground, with a rake of about eighteen inches, about one half to two thirds of which remains after span-wiring. Eyebolts are used for attaching span-wires, which are of seven-strand $\frac{17}{64}$ inch galvanized iron cable. With iron poles the eyebolt is passed through the wooden plug and the pole-top, and carries a No. 24 porcelain knob, which is linked to it by small iron straps and bolts, the span-wire being fastened to the porcelain. Including the usual insulating hanger, there are thus three insulations between trolley wire and pole. When set, iron poles are raked 8 to 10 inches, and they are tamped with concrete containing Portland cement to the extent of about half a barrel per pole.

For the pull-offs of an ordinary curve, making an arc of 90 degrees, and of 40 to 60 feet radius, it is customary to set three 33-foot poles on the outer street-corners, giving each pole three or four pull-offs as most convenient. Ten or eleven pull-offs is the usual allowance for a curve usually met with, but exceptionally long curves, or those peculiarly situated, have more, with extra poles to carry them. Where the pull-off wires are of considerable length they are brought together at a "bull-ring" of ½-inch round iron some distance from the pole to which it is attached by a single main pull-off. The pull-off wires are invariably insulated from the trolley wire, at the trolley wire and not at the pole or bull-ring, except in the case of double-track curves, where the pull-offs between the outer and inner wires are uninsulated. Frogs and uninsulated adjustable cross-overs are all braced in position by insulated pull-off wires.

With but few exceptions, all the overhead parts used in the trolley construction are of the standard General Electric type. Part of the straight line work is built with the Lieb "automatic" ears, but on most of it the soldered ear, with cast-iron "body" and insulating cap and bushing, is used. For curves, the "goose-neck" type of uninsulated suspension-carrying wooden "goose-neck-insulators," is the standard. Strain-ears and strain-insulators, frogs, crossings, splicing-sleeves, etc., are of the same manufacture. Of the various kinds of trolley section insulators employed, the "Philadelphia" type, made by the H. W. Johns Company, has proved its superiority. The Johns square and adjustable insulated trolley crossings are also used exclusively. The lightning arresters are of both General Electric and Westinghouse makes.

Each trolley line is entirely separate and distinct from every other, though by throwing the proper switches they could all be joined together. Further, each line is divided into sections averaging 2300 to 2600 feet in length; in the lines first equipped the sections were 3300 feet. The feeding points are all at the ends of the sections, at the section insulators; each feeder dividing at the section insulator and feeding both ways from it. The section insulator is carried on a pair of feeder span wires of No. 0 copper, to which are fastened the brass ends of the insulator. The feed-spans are run down the pole into the section-box, each through its own fuse-block and single-pole switch in the box, and are then joined together and to the feeder wire that brings the current to that point. By this means the trolley wire is made practically continuous, when both switches are closed, and its conductivity throughout its whole length is added to that of the feeder system that supplies it. In order to completely throw out a section one switch has to be opened at each end of it. A diagram of the connections at a section box is given in Fig. 7.

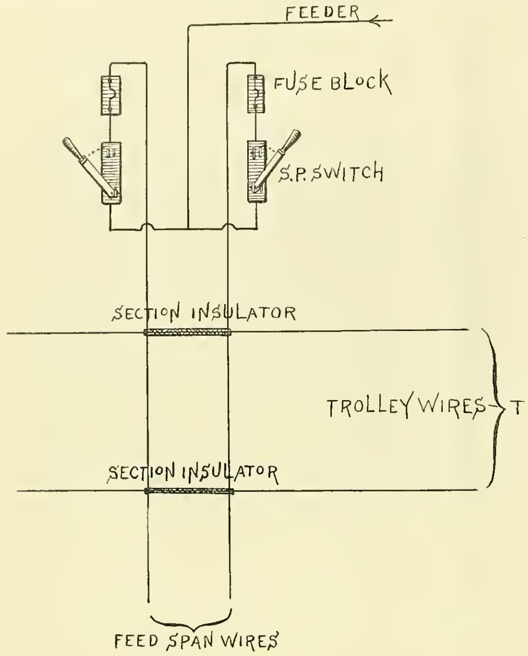


FIG. 7.

Aside from accidents due to the falling of foreign wires upon the trolley, the most frequent point of breakage is at a sectional insulator, particularly if the insulator and the trolley wheel do not work together properly. During construction the precaution was taken to attach strain-ears to the trolley wire at the spans adjacent to the feed-spans, on both sides, and to guy them toward the feed span, so that in case of a break they hold the line and prevent undue strain on the other hangers and span-wires. With certain kinds of section insulators this system of strain-guys is an absolute necessity.

All the street-car lines in New Orleans converge on Canal Street (with the exception of the New Orleans & Carrollton Railway), and the tracks occupy a broad strip of ground running up and down the middle of the street. This strip is locally known as the "Neutral Ground," having once been the boundary between the upper and lower districts of the city. From Front Street near the Levee, to Magazine Street, there are four tracks, constituting the main terminal of the New Orleans Traction Company's lines. From Magazine to Carondelet Street, there are three tracks used for motor cars, and beyond Carondelet Street, two tracks, the central track thence being devoted entirely to the use of the West End steam-dummy trains. The illustration (Fig. 8) shows the four-tracked portion in the foreground, the photograph being taken from a point near the intersection of North Peters Street. As there is a line entering Canal Street at every street for eight or nine blocks the trolley construction is somewhat complicated.

Photographs are also here reproduced of several other interesting points. Fig. 9 shows Trunk Line No. 1 turning the corner of Felicity and Market Streets. This being an obtuse angle, recourse was had to the special cross-arms previously described, which were all heavily braced together and to the pole. As there was no street opposite the corner down which guys could be run, it became necessary to purchase from the colored church on the corner the right to set two guy stubs in the rear of their church lot, one in each corner, in order to secure a reliable anchorage for the corner poles. Each of them carries three guy-cables.

Another interesting corner is at Magazine and Richard Streets, where Trunk Line No. 3 branches from a junction pole carrying three frames, Fig. 10. The view is taken looking down Magazine Street. The bus-bars are distinctly shown in position on the junction-frames, as is also the method of guying the pole by attaching the V-guys to vertical equalizing timbers, 3 x 12 inches, that pull equally on all three frames and relieve the pole of all lateral stress. Behind the building, at the extreme left, is an iron guy-stub, and in the air at the points of the V-guys are the quadruple-yoked giant strain insulators previously described. Trunk Line No. 1 is also shown again on the pole in the foreground passing above No. 3.

The principal distributing point at the upper end of Trunk Line No. 3 is shown in Fig. 11, which also displays the standard trolley-curve construction, also the single bracket-construction on Louisiana Avenue.

Before closing, it may not be amiss to mention the *personnel* of the electrical engineering department. When the general reconstruction was begun, under the direction of Mr. H. M. Littell, then general manager, he selected as electrical engineer Mr. Ben Willard, who had won a high reputation as a member of the engineering staff of the Thomson-Houston and the General Electric Companies. Under his personal supervision and management the work was carried on from January,

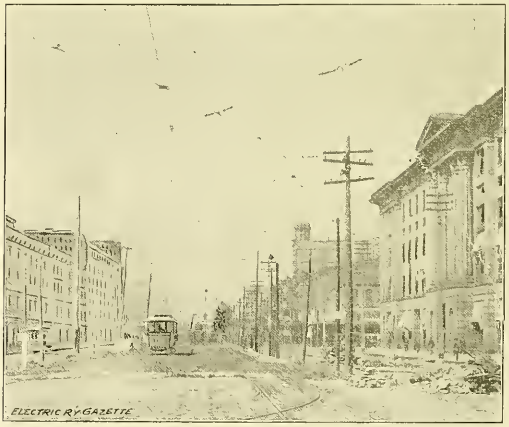


FIG. 8.

1894, until his promotion to the position of general superintendent in April, 1895. About all of the original special designs herein illustrated were outlined or suggested by him, and worked out in detail by his subordinates. The first general foreman was Mr. Lewis Degen, who carried out the heavy feeder construction, or Trunk Lines No. 1 and No. 2, besides a considerable amount of trolley work on the Canal, Prytania, Peters Avenue, Esplanade and Dauphine lines. He was succeeded in a few months by Mr. A. W. McLimont, who superintended the building of Trunk Line No. 3, and of the Magazine, Coliseum, Annunciation and Tchoupitoulas trolley lines. In May of the present year the writer, who had been hitherto employed as general engineering assistant, was given charge of the completion of the work, consisting of the French Market, Carondelet and Henry Clay Avenue, Villere Street and Levee and Barracks lines, besides Trunk Line No. 4, and the maintenance of all the lines in operation. Mr. William Baird has been for over a year foreman of feeder construction, and Messrs. W. B. Eicholtz, George Mayo, William Hudson and William Ure have been foremen of trolley construction. To the technical skill and faithful, conscientious performance of duty of these foremen, to whom was allotted the execution of the work, is due in very great measure its unqualified success. The business details of the electrical department were executed by Mr. Edwin Wenzel, now purchasing agent of the company, whose skill with the camera also is well attested by the excellent photographs which illustrate this article.

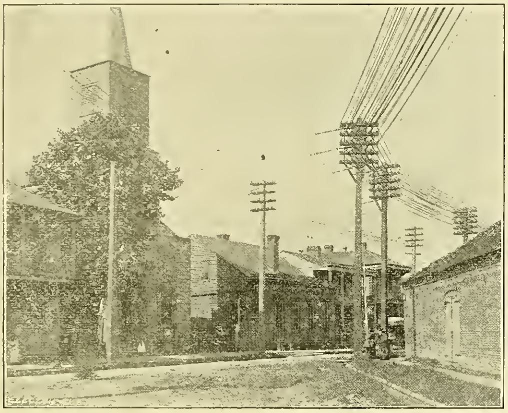


FIG. 9.

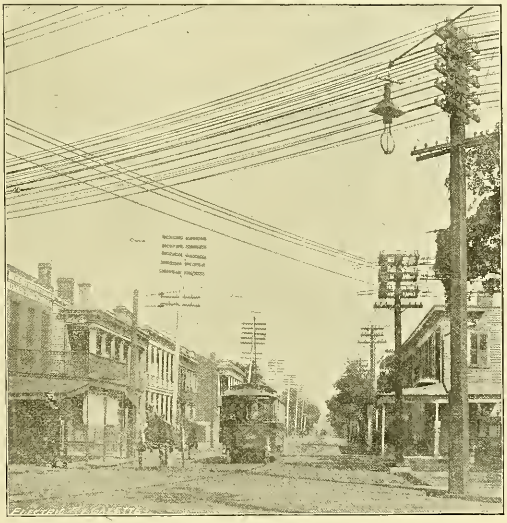


FIG. 10.

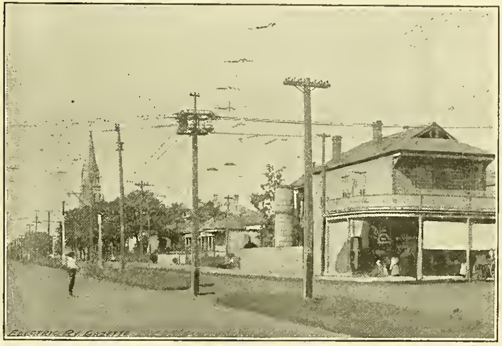


FIG. 11.

Electric railway construction being practically a new business in New Orleans, much difficulty was encountered in procuring some of the peculiar materials from local establishments; and the long distance from the nearest large markets often caused great annoyance in delaying the arrival of outside orders. Skilled labor, of the class demanded for the execution of neat and durable line work, was not to be found in New Orleans. All the skilled workmen, with hardly an exception, were drawn from other cities. But in spite of all these difficulties the work now nearing completion has been continuously maintained at the same high standard as at the outset, which is further attested by the fact that some of its special details are being adopted by the other local railway systems now in process of reconstruction.

New Fender Ordinance Proposed in Brooklyn.

Mayor Schieren, of Brooklyn, has recommended a new ordinance to compel street railway companies to equip their cars with fenders, to take the place of the regulation which was recently declared invalid by a court. The measure provides that every electric car shall have attached to it "a fender in front of the front platform of said car, which shall be deemed to be the platform at the end of the car in the direction in which such car shall be traveling. Each of such fenders shall be not less than five feet in width, and of such construction and so attached that it will project from a point (four inches or thereabouts from the dashboard and six inches or thereabouts higher than the floor of said platform) outward not less than four feet and down to within eight inches or thereabouts of the rails, and the body of said fender shall consist of rope, wire, rubber or other flexible netting."

It is provided that any company which fails to comply with the provisions of the ordinance shall be subject to a fine of $100 for each day a fenderless car is operated.

The Mechanical Efficiency of Electric Traction.

BY G. T. H.

Experts and electricians have combined their efforts to produce efficient generators and motors, but once having secured a goodly percentage of mechanical power from the power-house to the axle of the motor they have retired with a sense of duty well done. It is the object of this article to trace the power from the pinion of the motor and to discover the various places where it is expended. The consumers of power in an electric railway equipment may be divided into two classes: First, those which are inevitable, no matter how perfect may be the machinery, and second, the machinery itself. The first consumers are mere transformers of energy from kinetic to potential or *vice versa*, and the energy which they absorb may be reconverted into energy useful in propelling the car, while the second consumers convert the energy which they appropriate into uniformly diffused heat, and it is then to all intents and purposes lost. All of the energy supplied to the car is ultimately lost in this degradation to uniformly diffused heat; but it remains to the careful designer, and no less to the careful motorman, to see to it that this consumption of energy shall incidentally be utilized to propel the car a maximum distance.

In case of the first division of energy consumers, the number of car-miles obtained by this particular consumption depends upon the motorman and the conditions under which he is compelled to act. This consumption may be divided into two classes: First the energy necessary to raise the car on grades; and second, the energy necessary to start the car when on a level. The first is a simple matter of foot-pounds, and is the product of the distance raised in feet by the weight of the car in pounds. Not a particle of energy is lost by this transformation, but it is subsequently wasted by the imperfect mechanism and the motorman's brake, both of which convert it into uniformly diffused heat. By coasting as much as possible and braking as little as possible, the motorman will have done his part, and it remains for the designer to do the rest.

The second inevitable loss, the energy expended in starting the car, is seldom considered by street railway managers. Were the car absolutely frictionless this energy would still be consumed. Supposing the weight of a car to be 10,000 pounds, and that it had imparted to it a velocity of 10 miles per hour, or 14.67 feet per second, the energy imparted is approximately 33.400 foot-pounds, and is dissipated in heat at the next stop by the motorman's brake, unless he shuts off the current and coasts to his stopping-place. Even in the latter case it is lost in heat, but has incidentally moved the car through a very much longer distance.

Hence the fewer stops a motorman has to make the less power he uses, for he does not have to come up to speed so often. This argues the great economy of having definite stopping-places. Stopping at every block or half block is perhaps not more convenient to the public on the whole than stopping at longer intervals, for while in the former case one person may be accommodated, all the passengers in the car lose time.

The second class of losses may be reduced by excellence of mechanical construction, but never can be wholly eliminated. This class is wholly included in the draw-bar pull on level grade multiplied by the linear distance that the car travels, but it sub-divides into many interesting classes. The distribution of energy on a motor car is shown in the following skeleton, and the sub-divisions of the latter class of losses may be clearly seen.

Mechanical Energy.
- I. Inevitably absorbed.
  - 1. Energy in lifting cars on grades = WH
  - 2. Energy in imparting momentum = $\frac{1}{2} M V^2$
  - Lost by brake-shoes or by II.
- II. Traction Coefficient × weight × distance.
  - 1. Gear friction.
  - 2. Bearing friction.
  - 3. Rolling friction.
  - 4. Skidding.
    - *a.* Motor skidding.
    - *b.* Curve skidding.
    - *c.* Skidding on straight track.
  - 5. Vibration.
  - 6. Air resistance.

Uniformly Diffused Heat.

The first of these friction losses, gear friction, depends upon the load the motor has to carry, and the accuracy and finish of the gear teeth. It is always quite sensible, and it is difficult to reduce it beyond a certain limit.

The second, bearing friction, depends upon the nature and workmanship of the bearing and the weight upon it. It has lately been much reduced by ball or cylinder bearings.

The third, rolling friction, depends upon the trueness of the wheel, the smallness of its tread, and the clearness of the track. Much of this friction could be obviated by the use of a scraper brush, by employing which additional rail contact for current could be obtained.

The fourth cause, skidding of the wheels, is sub-divided into three classes. Motor skidding, Class *a*, is due to the motors failing to work in unison. This matter has been amply discussed in an article by Mr. Paul Hoho, recently published in the GAZETTE. The skidding on curves is only momentary and the energy lost is greatly reduced by liberal lubrication.

The loss classified in the *c* division is important, first, because it is constant; second, because it is frequently unnoticed, and third, because it can be completely avoided. The wheels of a motor car are rigidly connected together on the same axle, and if one is greater in diameter than the other, the smaller one will skid. This will be aggravated as time goes on, for the constant rubbing will wear away the smaller wheel more rapidly. The power lost is no inconsiderable factor, for cases have been frequently found where wheels supposed to be the same diameter varied as much as one inch. This means that the car is dragged bodily on the smaller wheel three inches for every turn of the axle. At 10 miles an hour this means a dragging of 25 feet per minute, and with a heavy car no small amount of power is thus lost.

The fifth loss may be largely avoided by efficient spring suspension. Vibration of any kind costs power. The sixth loss depends upon the shape of the car; it is trifling at low speeds, but at high speeds it becomes serious, and at present no steps have been taken to reduce it.

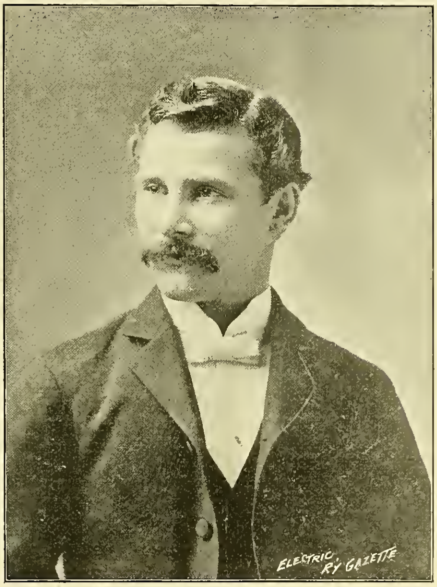
End of Horse Cars in Detroit.

The last trip of a horse car in Detroit recently was attended by an unusual public demonstration. After the trip was concluded the car was carried away in pieces by relic hunters. The team was auctioned off, and brought $100. The money was added to the Mayor's fund for the relief of the sufferers from the explosion in the Detroit *Journal* Building.

Street Railway Engineers—XXVII.

WILLIAM CHAPMAN.

Mr. William Chapman has had an extended experience in the field of electric traction. He was born in Birmingham, England, in 1864, and was educated at King Edward IV. grammar schools. At the age of 14 he entered the employment of the well-known firm of engineers, Tangye Brothers, Cornwall Works, Birmingham. He was rapidly advanced until he was one their leading mechanics and remained in their employ some eight years. Having a natural aptitude for mechanical and electrical subjects, all his spare time was spent either in experimenting or attending the science classes of the Birmingham and Midland Institute and the branch classes at Cornwall Works. At an early age he undertook any sort of electrical work he could obtain, from the erection of lightning conductors and the installation of electric signals, bells, telephones, telegraphs, etc., to the installation of isolated electric lighting plants.



WILLIAM CHAPMAN.

In the early part of 1886 he decided that he would have a much wider field in the United States, and he took up his residence in the suburbs of New York. His first position in the States was in an engineering establishment; but he soon decided to devote his energies entirely to work in the electrical field. He entered the services of the Richmond Light, Heat & Power Company, and took charge of the experimental, testing, repairing and engineering department. He remained with that company for three years, when he resigned to enter the electric railway field. For some time he was in the employ of New York contractors and built trolley roads in many parts of the country. In 1892 he was employed by the Wheless Electric Railway Company, of Washington, D. C., as engineer on the construction of a sectional conduit system then being installed on the tracks of the Washington & Arlington Railway. This was one of the earliest successful conduit systems installed, and during the time the road was in operation it worked with success. In the early part of 1894 he was appointed engineer and superintendent of the Electro-Magnetic Traction Company, of Washington, D. C., which had bought the patents of Malone Wheless on sectional surface contact (or closed conduit) system of electric street railways. This was an entirely new departure in the electric street railway systems. Many difficulties were met with in the development of this system, but all were speedily overcome. The first line equipped with this system was the North Capitol Street branch of the Eckington & Soldiers' Home Railway, Washington, D. C. This line has been in operation some 15 months. The control of the Electro-Magnetic Traction Company has recently been acquired by the Westinghouse Electric & Manufacturing Company, and Mr. Chapman has been appointed superintendent and engineer of the electromagnetic system. He is at present in charge of the installation of several miles of this system, for hauling and shunting freight trains in the yards and shops of the new factories of the Westinghouse Company, at East Pittsburg, and he is designing this system for substituting electric locomotives for steam on the standard railways.

Boston West End Company's Annual Report.

The report of the West End Street Railway Company, of Boston, for the year ending September 30 last, has just been made public. The company now controls 274 miles of tracks, and of this total about 10 miles were added during the year. There are 248 miles of track completely equipped for electric traction, and 9 miles are partially equipped. The overhead feeder lines have a total length of 261 miles, and 23 miles of feeders are buried. Fourteen miles of electric return wires are underground. For reconstruction of tracks $115,891 was expended during the year, and $182,591 was charged to the construction account. The general balance sheet shows that the cost of the road, equipment and real estate was $22,925,257. The company's equipment comprises 1725 electric cars, including 11 mail cars; 2108 electric motors, 115 electric snow plows, 541 horse cars and 857 horses.

During the year the cars traversed 22,181,125 miles, of which 95.13 per cent. is credited to the electric cars. The passenger receipts aggregated $7,624,276, of which 96.2 per cent. was collected on electric cars. The number of passengers carried was 155,231,506, and the average receipts per passenger were 4.912 cents.

The gross earnings were $7,746,170, an increase of $922,291 over those of the previous year. Among the items making the total receipts are rent of tracks, $26,577; advertising, $54,669; and carrying United States mail, $5828.

The operating expenses were $5,633,163, an increase of $826,080 over the preceding year, and the net earnings were $2,113,007, an increase of $96,211. Among the items charged to operating expenses are the following: General expenses, $594,017; maintenance of track, $692,050; maintenance of cars and vehicles, $623,449; maintenance of horse equipment, $119,719; maintenance of electric equipment, $470,005; road and snow expenses, $144,791; transportation expenses, $2,698,139; injuries and damages, $240,000.

During the year dividends aggregating $1,102,525 have been paid; the fixed charges aggregated $746,963, and a balance of $40,696 was carried to the surplus account, after writing off bad accounts.

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THE HORSE AND THE MOTOR IN BOSTON.

The annual report of the West End Street Railway Company, of Boston, of which a synopsis appears elsewhere in this issue, contains many figures of interest. The company operates most of its lines by electricity, and 95 per cent. of its income is derived from electric cars. Still, 857 horses are owned by the company, and it is interesting, if not instructive, to note the comparative values of the horse and electric equipments as revenue producers. During the fiscal year the receipts from the horse cars aggregated $289,760, and from the electric cars $7,334,516. The cost of the maintenance of the horse equipment during the same period was $119,719 and that of maintenance of the electric equipment was $470,005; these figures do not include in either case the cost of maintaining cars. In the case of the horse the cost of maintenance was 41 per cent. of the receipts, while the cost of maintenance of the electric cars was only 6 per cent. The comparison is not a fair one, for more horses are available than are actually required for the lines on which they are used, and at the same time the horse cars are not operated in the districts where there is naturally a large traffic to be expected. When all allowances, however, are made, the horse makes a poor showing as a revenue producer in comparison with the electric motor.

CLEVELAND'S ATTEMPT TO REPEAT HISTORY.

It would seem that one severe disaster should teach street railway employees at Cleveland a lesson. However, it seems that on Nov. 22, while the Superior Street draw was open, the current was suddenly cut off the railway trolley wire. The motorman of a Woodland Avenue car left his post without the formality of throwing to zero the controller handle. While the bridge was still open the current was turned on the railway wires, and the car became a runaway, and endeavored to push two cars in front of it through the safety gates. Fortunately, the gates were strong enough to hold back the cars or the Central viaduct tragedy would have been triply re-enacted. This incident demonstrates conclusively the utter unreliability of human manipulation under such circumstances. Automatic interlocking devices appear to be the only means of securing safety. The cars cannot be too completely disabled at such times. A derailing switch is more or less efficient, provided the car does not jump it, but automatically cutting off the current several hundred feet back of the draw is probably a more reliable method.

DISCHARGE OF FIELD COILS.

If a dynamo field coil of many turns be suddenly deprived of its exciting current by opening its electric circuit the result is a pulse or discharge at a maximum E. M. F., often exceeding many times that of the armature to which it supplies magnetism. A series field coil is never open-circuited when it consists of many turns, but shunt field coils are liable to this operation. The powerful pulse of E. M. F. excited by this self-inductive action will exhibit itself most frequently in the shape of a long, flaming arc, but very often it will prefer to strike a path for itself through some weak spot in the insulation of the field magnet or armature. The next time that the machine is started up it is found to be grounded, and either the armature or field magnet is obliged to go to the repair shop. Field discharges are very often capable of piercing through several thicknesses of mica, and have been known to penetrate as much as 1-16 of an inch of fibre. To avoid this the shunt field of a dynamo should be discharged very slowly by means of a rheostat. The field switch on a shunt machine is a worse than useless accessory, unless it is properly handled. Careful management in this regard will save many bills in railway power stations, as with machines of high voltage this evil is particularly pronounced.

CUTTING OF CYLINDERS.

Low-pressure pistons for railway engines of large power not infrequently weigh as much as 5000 pounds. When this weight is concentrated on the lower part of the cylinder-bearing surface and oscillated back and forth at the rate of 800 feet a minute, the cases where it does not cut the ordinary cylinder casting are more surprising and harder to account for than the cases where it does. Such cutting takes place when the piston is not provided with a tail rod, and is therefore most frequent in large cross-compound units of the horizontal type. In large units this cutting has become so serious a matter that the advantage presented by a tandem engine in the support to the low-pressure piston incident to its construction is considerable. It is true that there are cases where cross-compound engines with heavy pistons are working very successfully, but it is also true that the manufacturers have found great difficulty in duplicating these successful units. This points to fortunate circumstances in the casting of the cylinder rather than to excellence of design. Unless, therefore, marine practice is adopted and the cylinders of horizontal engines are supplied with bushings that will better resist wear, the conclusion would seem to follow that, other things being equal, the tandem design is better suited than the cross-compound for horizontal engines of large size.

THE DEMAND FOR A LIBERAL TRANSFER SYSTEM.

The prediction recently made in these columns that the practical abolition of the free transfer system in Philadelphia would occasion a vast deal of public criticism has been more than fulfilled. Of late the consolidated company, which was responsible for the change, has been attacked on all sides. Efforts have apparently been made to cause the employees to organize for a strike, and in this connection the argument has been used that the chances of success would be excellent at the present time, because they would be supported cordially by the public, who have been disgruntled by the change in the transfer system. Mass meetings to condemn the course of the company for its treatment of the public and its employees have been suggested. Agitation to secure a reduction in fares by an act of the Legislature has been begun in a feeble way, and there has even been talk of securing legislation by means of which the city could gain control of the local railway properties. These attacks on the company are almost without exception unwarranted, and the public would ordinarily pay little attention to them, but at present they seem to excite no little interest, and the explanation may doubtless be found in the fact that the public is ready to listen to complaints of any sort, because it is dissatisfied with the course of the company. We are inclined to believe that a compromise will eventually be made to meet the public demand. The company justifies its action in abolishing the old transfer system on the ground that it gave to the passenger more than one equivalent for his fare ; that it was a development of reckless rivalry on the part of the companies before consolidation, and that it was abused by the public. Under these conditions the company holds that the continuance of the system would be a suicidal policy. There is doubtless a great deal of truth in this assertion, but, at the same time, the public will not be likely to find much force in it; they will be mindful only of the fact that privileges once granted are no longer obtainable, and they will not be satisfied until some plan approaching the old transfer system in point of liberality is in force. It is interesting to note in this connection how much the company has done and is doing for Philadelphia and its residents. The facts are taken from a recent statement made by one of the directors. The three corporations which now compose the Union Traction Company, and which conduct a trackage system of 400 miles, have spent upon the streets $14,000,000. In addition the company keeps these highways in repair at no cost to the city and at an annual expenditure of about $450,000. Those two sums alone are about 12 per cent. of the gross receipts of the corporation, which amounts to about $10,000,000. It pays a State tax, from which the city obtains a benefit, which this year, through the three companies, amounted to about $450,000; a city tax of about $90,000 on dividends; a tax on cars, which aggregated about $90,000, and a tax on real estate of about $45,000. In other words, the city and State receive about 18 per cent. of the gross receipts of this corporation—a greater tax, the company claims, than any railway system in America is subjected to. Although it has made a vast investment, is liberal in its contributions to public expenses, and affords an admirable service, the public will not be satisfied until they enjoy still greater privileges, especially the privilege of a most generous transfer system.

Horde Conduit System.

In the railway conduit system which has been designed by the Horde Huetten Verein, of Germany, a number of existing ideas are ingeniously combined with several new ones. It is claimed that its cost is only 9 or 10 per cent. greater than that of the overhead trolley system. It consists of a bonded track, an inverted conduit for the conductor, and a commodious drainage conduit. The sides of this latter conduit are of sheet iron, which is stamped or corrugated at frequent intervals, so as to better resist earth pressures. The supporting yokes are stamped out of a steel plate 4 mm. in thickness, with ribs stamped into their sections, thus giving them great strength. The drainage conduit is formed of two pieces of sheet steel, which meet in the pointed bottom of the conduit. They are provided with end flanges, which are bolted to the yokes or trestles, as they are called.

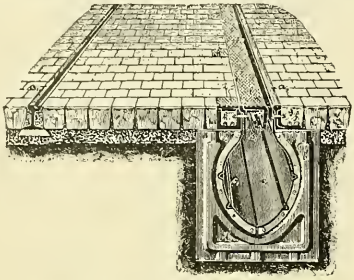


FIG. 1.—CONDUIT CONSTRUCTION.

The system involves the use of a single conducting wire, the track forming the return. Only a single conduit is therefore needed. This is constructed with profile iron and angle iron, so joined as to form an inverted U. The principal economical feature emphasized is that the conduit is in close proximity to one of the track rails, which therefore serves as both the track and slot rail. The slot is kept open and clean by the flange of the car wheel. The profile iron and angle iron are firmly braced by the rod attached to the further rail, as shown in Fig. 2. The trolley wire itself is supported on iron brackets by a holder very similar to that used on overhead systems. It is stated that the conduit may be laid as rapidly as a system of water piping, except on curves and where special work is necessary. The inventors are now working out a complete system of crossings and switches. The drainage conduit is connected at short intervals by pipes to the local sewerage system.

The trolley is flat and carries on its side a trolley arm capable of a limited universal motion, and is backed by spring pressure. The entrance of the conduit is curved so as to admit the trolley without catching it upon sharp edges.

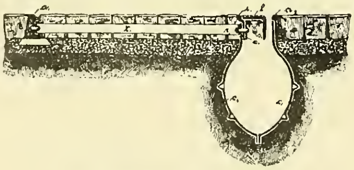
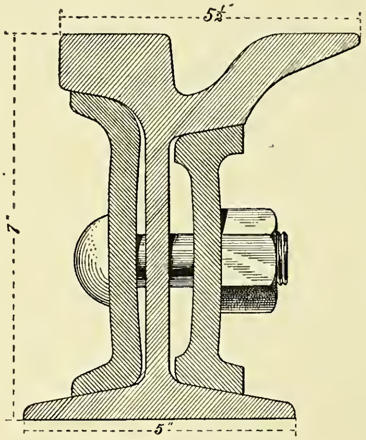


FIG. 2.—SECTION OF CONDUIT.

In order to protect the ironwork from rust, the parts are dipped in hot tar before being put in place. The whole construction, being rigidly bolted together, has great strength. The yokes will stand a vertical pressure of 5500 pounds, and an equal lateral pressure has been applied to the sides of the conduit without apparent injurious result.

New Street Car Rail.

The Metropolitan Traction Company has adopted a new rail, of the section shown in the accompanying illustration. It was designed by Mr. John D. Crimmins, and is intended to make the traffic of ordinary vehicles easier. With prevailing rail sections a broad, rectangular groove is made in the street, bounded on one side and the bottom by the rail, and on the other side by the paving blocks. The gauge of the track coincides with that of a great number of vehicles, and in such a case it is very difficult to turn out without giving the wheels a severe wrench. With a slippery rail it is often well-nigh impossible to turn out. Whatever the vehicle, it is almost certain to engage at least one of its wheels in these grooves, and thereby experience to some extent the difficulty indicated. The new rail obviates this by a broad guard flange, which is flush with the paving blocks. The groove for the flange of the car wheel is just wide enough to accommodate it, and is too small to allow the wheels of other vehicles to enter. The added weight makes the rail quite ponderous, but that is no mechanical disadvantage. The rail weighs 98 pounds to the yard.



CRIMMINS RAIL SECTION

New York Rapid Transit.

The General Term of the Supreme Court of New York has appointed Frederic R. Coudert, George Sherman and William H. Gelshenen commissioners to take testimony and submit a report as to whether the rapid transit roads should be built by New York City, notwithstanding the failure of the Board of Rapid Transit Railway Commissioners to get the required consents of property owners along the routes. The order gives the Commissioners 60 days to perform the work, and they are directed to advertise notice of the time and place of their first hearing. The order, in accordance with the previous decision of the court, reserves all questions as to the constitutionality of the Rapid Transit acts until the report of the Commissioners is presented for confirmation.

Brill Trucks and Their Manufacture.

One of the principal claims of the J. G. Brill Company in regard to its car truck is its enormous strength, and there is nothing to do but to concede this claim after considering the methods of manufacture. The argument of the company seems to be that while malleable castings are good, forgings are better. The pedestal of a truck is subjected to severe strains, and in its standard truck the Brill Company produces a forging that is essentially characteristic. Fig. 1 shows its evolution from a straight bar to the old familiar yoke. It is forged in a die to the shape of the central, rectangular piece, which is then bent around another die and forms the finished yoke. Two of these yokes are forged on the ends of a connecting bar, and the side frame is complete.

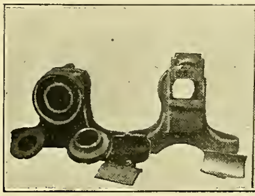


FIG. 1.

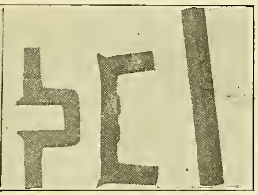


FIG. 2.

The truck has comparatively recently received a great improvement in the shape of a spring suspension upon the axle boxes, shown in Fig. 2. Two heavy ears are cast on the lower part of the box, on which short, spiral springs rest in pockets and take the whole weight of the truck. Thus the rigid riding portions are reduced to the smallest possible amount that present practice will allow. According to the old method, the yoke rested directly on a piece of rubber, the box and the yoke. While more or less effective, the method was open to several objections which have been entirely obviated by the springs. The box is very carefully made part of the truck. Fig. 3 shows a view of the box and its parts. The illustration speaks for itself. The inner parts of the box are provided with an efficient dust guard, and the outer part with a thrust plate, as shown. Particular care is used in finishing the bearing brasses, with a view to reducing friction, and a felt wiper, backed by spring brass, gives efficient lubrication. The Brill Company has been one of the few who have adopted the expensive refinement of grinding car wheels on their running centres. The importance of a well-formed tread and wheels of a uniform diameter, though at first sight slight, in reality cannot be overestimated. The slightest difference in size between the wheels will cause one of the wheels to skid and wear away, making the difficulty worse. Besides this, an enormous amount of power is wasted. Moreover, a perfectly cylindrical wheel will wear very much longer than one of imperfect outline, for, like the rough parts on the commutator of a dynamo, irregular places on a car wheel will tend to become worse. A wheel may be turned and may be fairly accurate, but absolute truth can only be obtained by grinding. Many firms now polish their wheels, but wheels so finished are never exactly true. An added advantage of grinding over turning lies in the fact that the wheel may be ground in its hardened condition, whereas the turning cannot be done unless the metal is soft. Subsequent hardening is likely to warp the wheel out of shape. The absolute truth of ground wheels, the Brill Company considers, pays in the long run, and gives the completed trucks a prestige. Fig. 4 shows the grinding machine; it is not only adapted to grinding the tread, but can also be employed in shaping flanges. A wet emery wheel is used. Besides the Standard truck, the Brill "Maximum Traction" truck, shown in Fig. 5, is an admirably designed piece of apparatus. This is intended for double-truck cars. The smaller wheels are simply guide wheels, the main weight of the car coming upon the larger wheels, which are driven by the motor. This arrangement gives the truck

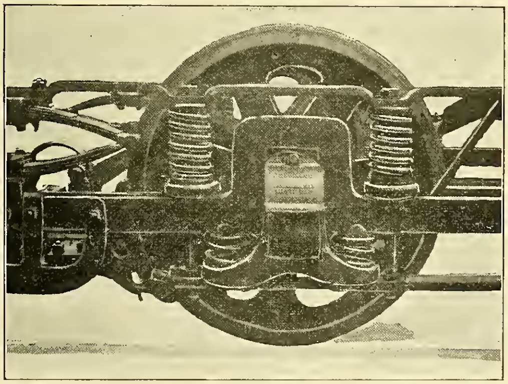


FIG. 3.

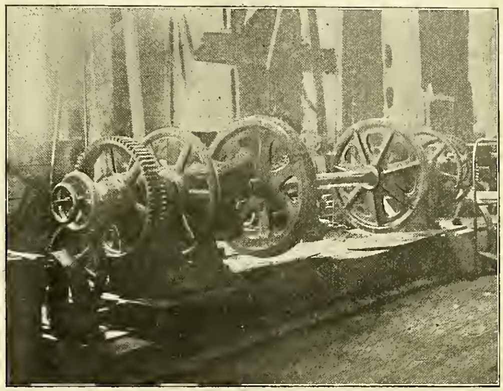


FIG. 4.

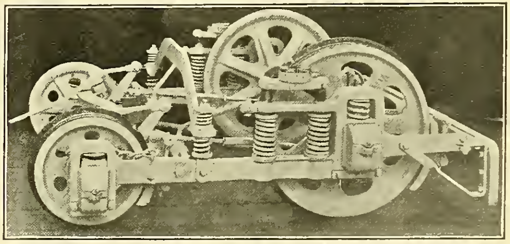


FIG. 5.

its name. A new and very substantial truck intended for heavy interurban traffic is shown in Fig. 6. This is also a double truck and is provided with a spring bolster and a forged frame.

The J. G. Brill Company, like many other successful firms, began on a small scale. The original concern was a firm known as J. G. Brill & Son, formed for the purpose of constructing tram cars of all descriptions. They had a small establishment covering about a half acre of ground on 31st Street, Philadelphia, south of Chestnut Street, and there the foundation of their now enormous business was laid. For four years they successfully carried on their enterprise and increased the capacity of the plant until their works covered about two acres. A limited working capital, the expenses incident to enlargement and the financial depression of 1872 placed them in a very unfortunate position. At this juncture James Rawle, the secretary and treasurer of the present company, took an interest in the business, and the name of the firm became J. G. Brill & Co. Their business from now on steadily increased. In 1886 their works extended over four additional acres. This met the needs of the firm for about four years, but in 1890 they purchased a large tract of land in Philadelphia at the intersection of the Pennsylvavia Railway with the Baltimore & Ohio, and there erected the present plant, covering about 18 acres of land. From a yearly output of 25 cars in 1868, the business has increased 1800 cars in 1895.

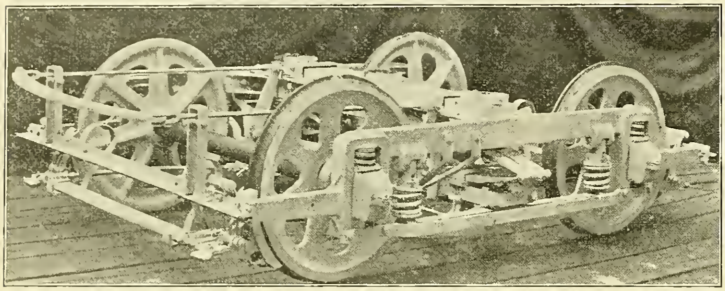


FIG. 6.

The Boston Subway.

The excavations on Tremont Street, Boston, at the junction of Park Street, are taken by many persons for work on the sewers and changing water mains. Two small sections of the subway have, however, been built at this point, and the contractor is now pushing the work onward as fast as possible. The excavation is covered with a big platform of wood between the car tracks during the day, and at night this is removed to allow the laborers to work. The prosecution of this work sets aside all doubts that the subway will be built through Tremont Street. Rumors have been spread that the Subway Commissioners would tunnel under Beacon Hill, and there are many persons at present who believe this. The tangle of pipes at Tremont Street, which would seem such a formidable obstacle has not disconcerted the commissioners, as is shown by their action in starting the present work. The cold weather makes the construction expensive, both through the labor of digging the frozen soil and the necessity of heating the sand to form concrete. When the temperature is below 20 degrees F. the concrete is not believed to be up to the standard and work cannot be carried on until the temperature is raised.

Loss in Uncovered Steam Pipes.

The *Improvement Bulletin* mentions that Mr. A. W. Haacke has been experimenting in the amount of heat lost by radiation through steam pipes. The tests were directed to determine the relative losses of heat from, first, bare pipes; second, pipes covered with one inch of insulating composition, and third, pipes covered with one inch of insulating composition and three layers of hair felt. The testing surfaces consisted of three cast-iron steam pipes of 5 inches external diameter, and 6 feet, long with blank flanges on each end. The pipes were supplied by steam that had been dried and so placed as to be subject to radiation and conduction under precisely similar conditions, one being bare and two others covered, as before mentioned. The results of the experiment are quite interesting. With steam at a pressure of from 45 to 60 pounds, out of a possible loss of 100 per cent. as much as 83 per cent. is saved by a one inch covering of composition. If over this covering one and one half inches of hair felt with canvas is added, the extra saving is only 8¼ per cent. If one pound of coal is required to evaporate eight pounds of water into steam at 60 pounds pressure, then every square foot of uncovered steam pipe wastes 6½ cwt. of coal per year. At a higher pressure of steam, and in cold weather, this loss is even greater.

Investigating Railways in Cities.

The committee appointed by the New York Assembly to investigate street railways in cities, to determine what changes are needed in the interest of the public, has held meetings in New York City this week. Representatives of the Dry Dock, East Broadway & Battery, People's Traction and Union Railway Companies were called as witnesses, but no facts of note were elicited. Dr. Albert Shaw, who has made a specialty of the study of municipal government, was asked to give his views on the municipal ownership of railways. He described the Glasgow street railway system, and said that its control by the municipality had been so successful that the same plan had been adopted in many of the principal English cities. The conditions in this country were, he said, somewhat different, and he had never advocated municipal ownership. He believed American companies ought, in return for the great privileges they hold, to make increased investments, to enlarge their facilities and give the people better and more comfortable service. He thought that if there is nothing in existing charters to prevent legislative remedy it might be possible to bring the whole business of transit in New York under a better and more efficient public supervision. The city authorities, he thought, ought to value more highly the privileges they have conferred so freely on the companies. He thought city governments or the people in some way should profit more from the franchises they dispose of.

Comments and Views of Contemporaries.

Women Conductors.—Women are taking so kindly to the amateur duties of the car conductor that it will not be surprising if some of them go a step further and make it a business. So far, it is true, their experience of the calling has been had under privileged conditions, but the impression is gaining ground that women could make successful car conductors just as well in America as in Mexico, where a female car conductor is no uncommon sight.—*Helena (Mont.) Independent.*

Fender Suggestion.—Let the Brooklyn authorities inquire carefully into the workings of various fenders which, it is reported, have been found practicable and satisfactory in other cities. A committee of experts might soon, and at small expense, examine these different fenders and report on their relative availability. And with such information it would not be difficult to select a fender which would be workable and much better than that now used on most of the Brooklyn cars.—*New York Herald.*

Personal Damage Suits.—As a matter of fact, as everybody knows, the great majority of suits for damages brought against the street railway company are either trumped up or in a large degree fictitious. In some cases the plaintiffs have got themselves hurt or mutilated in a slight degree in order to make a foundation for an action for heavy damages against the company. The slightest injury is magnified tenfold. Some of the lawyers who try these cases are guilty of things quite as bad as tampering with juries, and that is by the introduction of perjured testimony. In some instances their whole case rests on flat perjury.—*St. Paul Pioneer Press.*

To Prevent Accidents To St. Louis Children.—One of the companies has issued an order to the conductors commanding them to detain and turn over to the first policeman at hand all youngsters jumping on the steps of a car or on the fender. All conductors must obey this order. A leading official of the company in question said that the practice of little and big boys, and some girls, of jumping on cars and fenders must be stopped. "It is a violation of the ordinances," he continued, "and subjects the juvenile offender to two fines of $10 each and a lockup over night. The police look upon this particular infraction of the city's laws with indifference, notwithstanding their attention has been repeatedly called to it. So many policemen are riding on the cars that the conductors catching the boys will immediately turn them over to the policeman. We will catch the boys, and it remains to be seen if the man with the club will do the rest."—*St. Louis Globe-Democrat.*

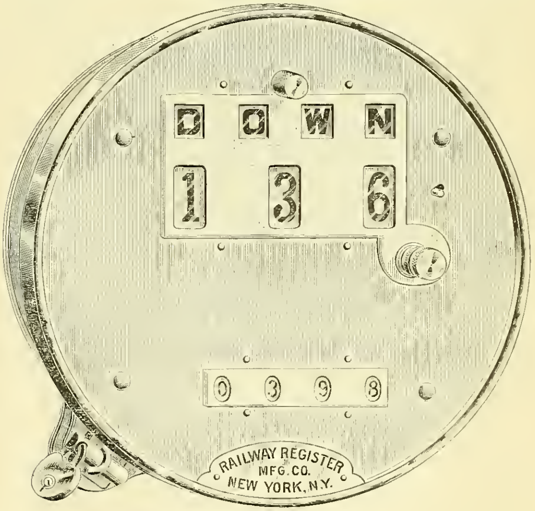
Future Trolley Car Advantages.—Among the street car advantages of the immediate future will be the opportunity any host with a houseful of guests at his home will have to step to his telephone and call up the headquarters of the street car company, ordering a parlor trolley car to be sent to him at once. He will be able to charter a car by telephone, and in it escort his guests to the theatre or on any excursion they may elect.—*Cincinnati Times-Star.*

Accidents on Electric Railways.—The danger makes it necessary that the cars should be supplied with the very best safety appliances, such as fenders and brakes, and that the motormen should be exceedingly vigilant and careful. Any symptom of recklessness or inattention to duty should be severely punished in the case of employees of electric cars, and the companies operating them should be held to a strict accountability where defective machinery or safety appliances are used.—*New Orleans Picayune.*

Speed of Electric Cars.—The public demands high rates of speed for these cars. The companies are not particularly eager for flights of speed. The patronage of the cars has almost doubled since the rate of speed has been doubled. This conclusively shows that the street cars are doubly attractive; twice as useful. Consequently, it is desirable that high rates of speed be maintained. The public has not grown familiar with these high rates of speed, and the result is that individuals get in the way of the cars and are hurt. This is the fault of the people. Of course, there are unavoidable accidents, but the greater proportion of them is the result of carelessness. Nobody has any right to cross down-town streets in a "brown study." He must watch for cars and other flying vehicles. The Supreme Court has said that a man must look and listen before crossing a railway track if he would be free from negligence when struck by a moving train. It is only necessary to look when crossing a trolley car's track. That much is necessary. Look both ways, wait until the car stops before getting on or off, and the flying trolley cars will get no victims. The public demands these high rates of speed. The public must get used to keeping out of the way. The cars have rights—and that is the whole thing. —*Detroit Journal.*

Street Car Fare Register.

The Railway Register Manufacturing Company, of 1193 Broadway, New York, has placed upon the market a street car fare register, which embodies many excellent features. It is pleasing in appearance; having a large blue dial face, with black figures on a white background. The summation register counts up to 10,000 and then resets itself. The trip register is locked by the direction plate, so that the latter must be turned before the register can be operated. This compels the conductor to set his register back at the end of each half trip. The general appearance of the register is shown by the accompanying cut.


DOWN
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RAILWAY REGISTER MFG. CO. NEW YORK, N.Y.

MONITOR FARE REGISTER.

FINANCIAL NOTES.

SOUTH JERSEY RAILWAY INSOLVENT.—H. H. Wainwright of Manasquan, N. J., has been appointed receiver of the South Jersey Street Railway Company of Point Pleasant, N. J.

HALIFAX (N. S.) ELECTRIC TRAMWAY BONDED.—The Halifax Electric Tramway Company has filed with the Eastern Trust Company, of Boston, a mortgage on all its property to secure an issue of debenture bonds amounting to $600,000.

PEOPLE'S TRACTION (N. Y.) FRANCHISE.—Comptroller Fitch has postponed for one month the sale of the franchise which was applied for by the People's Traction Company. The injunction obtained by the Southern Boulevard Company is still in force.

FREMONT, O.—The Fremont Street Railway system has been purchased by Dr. Frank Creager, who was one of its heaviest creditors, for $8720. The road is 1½ miles long, and was appraised at $14,075. It is reported that Eastern capitalists will take hold of the road and make considerable extensions and improvements.

THE LONG ISLAND TRACTION SALE.—The sale under foreclosure of the Long Island Traction Company's leases, etc., which was fixed for Dec. 5 at the New York Real Estate Exchange, may be deferred. Lawyer James C. Church has been retained by the stockholders who refused to approve of the reorganization scheme, to bring a suit to enjoin the sale.

THE CENTRAL RAILWAY COMPANY (PEORIA, ILL.) REORGANIZED.—At a recent meeting of the directors of the Central Railway Company it was voted to redeem $200,000 of the company's first mortgage and $100,000 of the second mortgage bonds, and to issue new bonds to the extent of $750,000, a large proportion of which sum will be used for improving the system.

READING CONSOLIDATION.—All lines operated by the Reading Traction Company at present, including the Black Bear line and the Reading & Womelsdorf Railway, will be merged into the United Traction Company, and application for a charter for the new organization will be made on Dec. 17 by Richmond L. Jones, the solicitor. The names of the corporators are William R. McIllvain, Henry C. England, James A. O'Reilly, Samuel E. Rigg and Oliver S. Geiger. The company will be capitalized at $400,000.

CONSOLIDATION AT PEORIA.—A special meeting of the stockholders of the Consolidated Electric lines of Peoria, Ill., was held at the company's offices in this city last week for the purpose of ratifying the action of the directors at a recent meeting. The capital stock was increased from $600,000 to $750,000, and the details of the recent consolidation were perfected. Hereafter the two systems will be operated under the name of the Central Railway Company. The stockholders authorized the issuing of $750,000 bonds for the purpose of taking up the outstanding bonds and improving the road. The stock of the new company is owned principally by Columbus R. Cummings, of Chicago; Walter Barker, J. B. Greenhut, Samuel Woolner, Jr., George H. Littlewood and other Peorians.

MASSACHUSETTS STREET RAILWAY EARNINGS.—The annual report of the Lowell, Lawrence & Haverhill Company for the year ended Sept. 30 shows a gross income of $403,530, an increase of $133,790 over 1894; the net income for 1895 is $140,595, as compared with $63,924 in 1894, and the report shows a net surplus this year of $56,513, as against a deficit of $8498 last year. The Worcester Consolidated reports a gross income of $420,498 for 1895, against $354,999 for 1894, and a net income of $110,787 this year, which is $40,002 greater than last year. The net surplus for 1895 is put at $2933 compared with $806 last year. The gross income of the Lowell & Suburban line for the past fiscal year is $329,806, or an increase of $52,777 over last year, and its net income is $130,460, as compared with $94,695 of the previous year. The net surplus is $30,925 against $6996 last year. The Lynn & Boston reports gross receipts of $1,376,977 as compared with $1,238,409 last year. The net income this year shows an increase of $100,497, and the surplus is $5554 greater than last year's surplus, which was $7780.

NEW INCORPORATIONS.

SOUTH SIOUX CITY, NEB.—The South Sioux City Traction Company, capital stock, $50,000, has been organized to maintain and operate one or more lines of street railway. Those interested are T. L. Eaton, Henry J. Taylor, C. A. Benton, D. L. Plumer and E. H. Burgess.

SIOUX CITY, IA.—The Central Traction Company has been formed for the purpose of constructing street railways, electric light and power plants and also to furnish steam-power. Those interested are Howard S. Baker, C. M. Swan, George P. Morris, Sioux City, Ia. Capital stock, $500,000.

PITTSBURG, PA.—The Pittsburg & Monongahela Traction Company has been formed for the purpose of building and operating electric railways in Allegheny County, Pa. Those interested are M. C. Bulger, Brownsville, Pa.; H. C. Johnson, Pittsburg, and M. S. Eakin, Allegheny. Capital stock, $12,000.

FORT WAYNE, IND.—The Fort Wayne Consolidated Railway Company has been formed for the purpose of purchasing, owning and operating electric and other railways in Fort Wayne. The promoters are Frank De H. Robinson, John H. Bass, M. S. Robinson and James M. Barrett. Capital stock, $2,000,000.

NEWS OF THE WEEK.

SKOWHEGAN, ME.—The survey of the electric railway from Skowhegan to Madison has been completed.

TITUSVILLE, PA.—The question of franchise for an electric street railway in Titusville is being considered.

WOONSOCKET, R. I.—The Street Railway Company has announced its intention to extend the trolley system to the Fair Grounds.

FREDERICK, MD.—The work of surveying a route for the electric railway between Frederick and Middletown has been completed.

SHERBROOKE, QUE.—The Government has passed a bill granting incorporation papers to the Sherbrooke Street Railway Company.

UNIONVILLE, PA.—The citizens of this place are anxious to secure the construction of an electric railway from here to West Chester.

OSWEGO, N. Y.—Application has been made by the Oswego Street Railway Company for the right to extend its tracks on Erie Street as far as Halsey.

NIAGARA FALLS, N. Y.—An effort is being made to form a company to build a single rail electric road from Fort Erie to Port Albino via Crystal Beach.

BROOKLYN, N. Y.—The Brooklyn Heights Railway Company has petitioned the Common Council for a franchise permitting it to lay tracks on Livingston Street.

NEWTOWN, PA.—The first trolley line to lay tracks in Bucks County is the Newtown, Langhorne & Bristol Railway Company, which began work at Langhorne this week.

CHARLESTOWN, N. H.—It is rumored that the construction of an electric road from Springfield to Charlestown is in contemplation. The estimated cost of the road is $100,000.

ALBANY, N. Y.—The Albany, Greenbush & Bath Railway Company and the Albany Railway Company presented applications for franchises at the last meeting of the Greenbush trustees.

JOLIETTE, QUE.—An electric railway between Joliette and Lanoraie, to make connection with commercial lines on the St. Lawrence, is proposed by the Chamber of Commerce of this place.

HYATTSVILLE, MD.—It has been definitely determined to build a line of electric railway through Hyattsville, 60 feet from and parallel to the tracks of the Baltimore & Ohio Railway Company.

VALPARAISO, IND.—W. W. Kimball, D. D. Phelps and W. W. Shope, of Chicago, are interested in a project which contemplates the construction of an electric railway from this place to Lake Michigan.

RENFREW, ONT.—A. C. Wright and others are interested in a proposed electric road between Renfrew and Portage du Fort, a distance of eight miles. It is proposed to operate the power-house by water-power.

BRISTOL, PA.—The Bucks County commissioners have granted a right of way for a projected electric railway from Philadelphia to Trenton, using the Homesburg, Tacony & Frankford Railway as a connecting link.

RED BANK, N. J.—The new electric railway company has made application for a franchise to lay tracks on Shrewsbury Avenue from the Shrewsbury & Tinton Falls Railway into Red Bank as far as Monmouth Street.

MONTCLAIR, N. J.—Mayor Harrison, of Caldwell Borough, has vetoed the ordinance recently passed by the Council granting a franchise to the North Jersey Street Railway Company for a trolley road on Bloomfield Avenue.

MILLBURY, MASS.—It is reported that James W. Stockwell and Thomas E. Meek are organizing a company, to be known as the Millbury, Sutton & Douglas Electric Railway Company, for the purpose of building an electric road.

XENIA, O.—It is stated that the George H. Mellen Company, of New York, has been awarded a contract by the Rapid Transit Company for the construction of an electric railway from this place to Springfield, a distance of 25 miles.

PITTSBURG, PA.—An ordinance has been passed granting the Federal Street & Pleasant Valley Passenger Railway Company the right to construct and operate a street railway on Charles Street from Erwin Avenue to Perryville Avenue.

BUFFALO, N. Y.—At a meeting of the Board of Aldermen, Alderman Summers presented the petition of the Buffalo Traction Company, asking permission to build and operate a street surface railway in the city of Buffalo, to be operated by electricity.

OXFORD, PA.—Farmers and citizens in the neighborhood of Cochranville have subscribed $14,000 and given rights of way for the proposed electric railway from Philadelphia to Lancaster, via Cochranville. A branch will be constructed to Oxford.

HAMILTON, ONT.—The Hamilton, Brantford & Pacific Junction Railway Company has applied for a charter to construct and operate a railway from a point on the Toronto, Hamilton & Buffalo Railway to Schau Station, on the Canadian Pacific Railway.

BROOKLYN, N. Y.—At the meeting of the Board of Aldermen on Nov. 25, an application was received from the Brooklyn City Railway Company for permission to build a double track trolley line on Livingston Street, between Flatbush Avenue and Court Street.

RICHMOND, IND.—It has been announced that an electric line is to be constructed from Dayton, O., to Richmond. John K. McIntyre, of Dayton, and some of the stockholders of the Barney-Smith Car Works have organized a company to put the line through.

WARREN, O.—The Trumbull Electric Railway Company is planning to extend its line from Warren to Leavittsburg early next Spring. Leavittsburg has a natural pleasure resort, which is expected to prove popular with Warren people and profitable to the railway.

PITTSBURG, PA.—On and after Dec. 1 the Suburban Rapid Transit Electric Railway Company will charge only one fare to the end of its line. Heretofore the company has been charging one fare to the toll-gate and another fare from the toll-gate to the terminus of the line.

WEST ORANGE, N. J.—The long-discussed franchise to allow the South Orange & Maplewood Street Railway Company to lay tracks across Tremont Avenue, Nassau and Union Streets, was finally passed by the West Orange Township Committee at the regular meeting, recently held.

BENTON HARBOR, MICH.—A franchise has been granted by the City Council to J. S. Clark, of Chicago, to construct five miles of electric street railway in Benton Harbor, with eastern terminus at Eastman Springs, where a large sanitarium will be built. The street-car system will cost about $75,000.

HAGERSTOWN, MD.—It is probable that the franchise granted by the City Council to the projectors of the new street railway will be modified so as to release the promoters from building a street railway to Williamsport, in accordance with their desire to build a road first from Hagerstown to Funkstown.

OTTAWA, ONT.—The Hamilton Radial Street Railway Company has given notice to Parliament of an extension of its Guelph branch to Lake Huron, and the Toronto, Hamilton & Niagara Falls Electric Railway Company has applied for incorporation papers for the purpose of constructing a road between the points named in its title.

SUFFOLK, VA.—The Suffolk Street Railway, an option on which was secured some time since by L. D. Smith and J. W. McCormick, of Norfolk, is to be sold to a party of Pennsylvania capitalists, who, it is reported, will equip it electrically and will extend the line to Lake Kilby, Fair Grounds and Springfield, and ultimately to Portsmouth.

CHICAGO, ILL.—It is stated that George S. Willets and W. G. McCormick, representing Baltimore parties, propose to establish a trolley road on Jackson Street from Michigan Avenue to Halsted, and thence through various streets to the Northern Pacific tracks. On West Taylor Street the new line will parallel the tracks now operated by the Yerkes syndicate.

PHILADELPHIA, PA.—An ordinance has been passed granting the Grand Boulevard Street Railway Company permission to use electric motors, to be supplied from overhead or underground wires, to erect and maintain poles to support the overhead wires, and to construct conduits between the tracks, on the streets along which the company's tracks are to be laid.

SAN JOSE, CAL.—At the meeting of the Board of Trade Committee for the promotion of the proposed Saratoga electric railway recently, reports were received from the various canvassers of such an encouraging nature as to establish, beyond a reasonable doubt, the success of the enterprise. Over $15,000 has already been subscribed by parties outside the city limits.

COLUMBIA, IND.—The Huntington, Columbia City & Ligonier Electric Railway, which is to be built by Indianapolis capitalists, has been granted its franchise and construction will be commenced immediately. A franchise has also been granted to the Fort Wayne, Columbia & City Electric Railway Company, and President Everett states that the road will be built within six months.

PITTSBURG, PA.—The City Comptroller will notify the street railway companies this week of the maturity of the city tax of $60 per year on each car and will urge the companies to pay the tax without delay or litigation. At this rate the car tax aggregates about $15,000, and as there are some flaws in the city ordinance providing for the levying of this tax it is probable that some of the companies will fight the matter.

NEW HAVEN, CONN.—It is reported that the New Haven Railway Company's officers will decide within a few days in favor of an electrical equipment of the Waterbury, Meriden & Cromwell Steam Railway. The line is about 20 miles long, running from Waterbury via Meriden to Cromwell on the Connecticut River, with right of entrance into the city of Middletown. It will require a power-house at both Waterbury and Meriden.

GREENSBURG, PA.—The first section of the Greensburg, Jeannette & Pittsburg Electric Railway, between this place and Jeannette, five and one half miles long, was opened on last Saturday and the work of extending the line beyond Jeannette to Wilmerding is progressing rapidly. The road will probably connect at Wilmerding with the Second Avenue road of Pittsburg, forming a through line between Greensburg and Pittsburg.

SOUTH NORWALK, CONN.—Judge Curtis of the Common Pleas Court, Bridgeport, on Nov. 24 issued an injunction restraining the Norwalk Street Railway Company from laying tracks across West Washington Street in South Norwalk, connecting the main line with the recently constructed branch through Railroad Place. The issue was issued at the instance of the attorney for the Norwalk Tramway Company. The Norwalk Street Railway Company succeeded in having the injunction so modified as to permit a connection to be made, but there remains a clause preventing the running of cars.

BOSTON, MASS.—William H. Lincoln, agent of the Leyland Steamship Company, W. A. Bowland, late organizer and director of the Nassau Street Railway Company, of New York; Alfred D. Chandler, William I. Bowditch, Dr. Channing, Hon. M. P. Kennard, F. Bouve, treasurer of the Bouve, Crawford & Company Corporation, of Boston, and Anson M. Lyman, all of Brookline, Thomas Garfield and Samuel Jackson, of Newton, are interested in the contemplated electric street railway line to run from Newton Centre to Brookline, and later through Newbury Street Boston, and to enter the subway at Arlington Street.

CHICAGO, ILL.—A complete trolley loop around the business district is the latest plan of Charles T. Yerkes. The North Chicago Street Railway Company is to apply for an ordinance permitting the erection of trolley poles and wires in Dearborn Street from Lake Street to the Polk Street depot. It is stated that while the ostensible object is to give an entrance into the heart of the business district for the North State Street electric cars, which now stop at Lake Street, the real motive in stringing wires in Dearborn Street is to complete the trolley loop, of which the other three sides will be composed of the electric connections placed directly underneath the "L" loop structure in Lake Street, Fifth Avenue and either Van Buren or Harrison Street.

DETROIT, MICH.—The fight between Mayor Pingree and Tom L. Johnson waxes more and more interesting. It is now stated that the Mayor proposes to grant the Detroit Railway the right to run cars on Mr. Johnson's tracks. Mr. Johnson, of course, will not lie down and quietly allow Albert Pack's street cars to use his tracks and carry the passengers that he would otherwise get. He will probably apply for an injunction the moment the proposed ordinance is passed. This will get the case before the Michigan Supreme Court, and that is what the Mayor wants. The old fight as to the legality of the Citizens' Company's ordinance, which the United States Court of Appeals decided against the city, and which the United States Supreme Court refused to touch, will be opened again.

CHICAGO, ILL.—Work has begun on the system of block signals at the crossing of the Division Street electric cars and the Chicago, Milwaukee & St. Paul Railway at North Halsted and Division Streets. This system comprises a section insulator in the trolley wire of the electric railway company, 600 feet from the crossing, and a switch, controlled by the steam railway safety gates, and adapted to cut in or out the stretch of trolley wire between the section insulator and the crossing. Thus, when the railroad gates are down the trolley wire is dead for 600 feet back, and an approaching car can only go as far beyond the section insulator as its momentum will carry it. This system is particularly effective at night as an automatic signal also, inasmuch as the lights in the electric car are, of course, extinguished when the car enters the "dead" section.

TRADE NOTES.

THE HASCALL-RICHARDS STEAM GENERATOR COMPANY, of 36 Bromfield Street, Boston, is introducing a new attachment for boilers, consisting of a frame-work of pipes to be located immediately under the shell of the boiler, the object being to furnish additional heating surface and increase the steaming qualities and capacity of the boiler.

THE DIAMOND STATE COMPANY has established a factory and offices at Elsmere, Wilmington, Del., for the purpose of manufacturing hard fibre for electrical insulation and other purposes. The factory is completely equipped with machinery of the most modern type, and it is stated that the new company has already received great encouragement in the way of substantial orders from good firms.

THE SOUTHERN ELECTRICAL CONSTRUCTION & SUPPLY COMPANY is the style of a new concern which has recently established headquarters in Norfolk, Va., for the purpose of doing general construction work and handling high-class electrical specialties. Mr. Paul K. Browd, the manager of the new company, and Mr. Beardsley N. Sperry treasurer, are both electrical engineers of considerable and varied experience, as well as men of fine business qualifications.

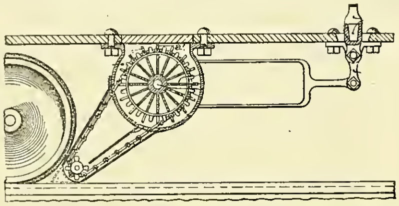
MURPHY-PIERCE CONDUIT SYSTEM.—The electric railway system invented by John M. Murphy and Albert F. Pierce, of Danbury, Conn., is to be introduced on a section of road at Westport, Conn., and a practical test will take place on Dec. 15. In this system a third rail, arranged in short sections, is laid between the track rails. Each section is insulated from every other section. The car in passing makes alive the section directly beneath it. This is accomplished by causing one of the wheels to come in contact with a push pin which operates a mechanism placed underneath the rail. As the car advances the wheel touches a second push pin and cuts out this section. The feeder wire is buried on the outside of the track. The system is controlled by the International Electrical Company.

J. P. SJOBE & CO., manufacturers of street-car wood-work, 155–157 Eleventh Avenue, New York City, are receiving some large orders from leading car builders for their new car sash and blind spring. This device consists of an elliptical spring, the two members of which are offset laterally so that one may be inserted between the sash stile and the stop, while the other is sealed on the stile outside of the stop, and is fastened thereto, so as to form a simple, efficient and reliable spring that may be readily applied to any window for preventing rattling or for holding the sash when raised if desired. An order for 5000 of these springs has just been received from one of the largest car-building firms in the country, and a noteworthy fact in connection with this order is that it was the first one given by the company referred to.

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED NOV. 19, 1895.

549,899. PLATE FOR STORAGE BATTERIES AND PROCESS OF MAKING IT; Francis J. Clamer, Philadelphia, Pa. Filed Dec. 20, 1893. In a storage-battery plate a porous jacket consisting of lead and aluminum alloy formed in the shape of an envelope and filled with the active material.

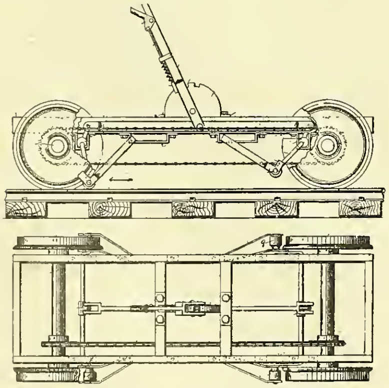


NO. 549,985.—POSITIVE FEED CAR TRACK SANDER.

549,920. UNDERGROUND TROLLEY SYSTEM; Charles E. Hubbs, Streator, Ill. Filed May 23, 1895. In an underground trolley system the conduit having a centrally depressed bed connected at suitable intervals with a drainage system, the yokes placed at intervals and supporting in their part and at one side of the slot the active wires.

549,985. POSITIVE FEED CAR TRACK SANDER; William Westheffer, Lancaster, Pa. Filed March 25, 1895. A sand box containing a wheel to agitate its contents, a chute to direct the sand upon the track and a moving chain running over a sprocket wheel in the chute to disrupt the sand when it becomes packed therein. (See Illustration.)

550,000. CAR BRAKE; Daniel H. Grant, Raymore, Mo. Filed Aug. 20, 1895. A car brake mechanism consisting of a chain passing around two sprocket wheels movable on the axles. On its lower end the chain carries rock shafts, which, when the former has longitudinal motion, forces a wheel-shaped shoe between the wheels and track. The chain is moved by a lever pivotally mounted and engaging its upper length. (See Illustration.)



NO. 550,000.—CAR BRAKE.

550,008. SELF-PROPELLING VEHICLE, BOAT, ETC.; Geo. A. Washburn, Cleveland, O. Filed March 6, 1895. In a self-propelling mechanism for either boat or vehicle, a dynamo-electric machine connected to the propelling mechanism, adapted to be driven by any prime mover, having means for disconnecting and connecting it to the driving axle, and combined with an electric accumulator to actuate the device as a motor when desired.

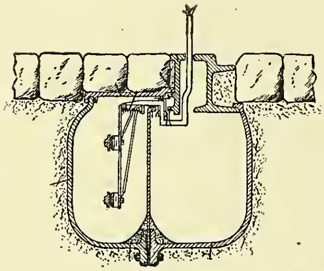
550,011. RAILWAY CAR BOLSTER; Henry C. Williamson, Michigan City, Ind. Filed June 6, 1895. A railway car bolster built of two steel strips riveted together and suitably braced, with projections for the spring suspension.

550,045. SLACK ADJUSTER; Henry S. Goughnour, Johnstown, Pa., assignor to the Johnson Company, Lorain, O. Filed Sept. 14, 1895. In a brake rigging for railway cars, the combination of a transverse brake beam, a longitudinally extending brake rod, said rod having a forked end suitably pivoted to the brake beam, a slot in the forked end and wedges and slot adapted to act upon the brake beam, and means for locking them in position.

550,057. CLOSED CONDUIT ELECTRIC RAILWAY; Herluf A. F. Petersen, Milwaukee, Wis. Filed Oct. 29, 1894. A closed conduit electric railway system in which the main conduit is divided into two parts, one directly under the slot for drainage purposes, and one at one side of the slot carrying the active conductors. (See Illustration.)

550,059. TROLLEY; Francis J. Pribyl, Hazleton, Pa. Filed March 9, 1895. On a trolley road a pivotally mounted spindle with right and left spiral grooves which engage with the trolley wire and guide it onto the wheel.

550,060. FOOT GUARD FOR RAILWAY TRACKS; Joseph K. Rile, Centreville, Mich. Filed May 2, 1895. In a foot guard for railway tracks a longitudinal plate forced into position by strong spiral springs.



NO. 550,057.—CLOSED CONDUIT ELECTRIC RAILWAY.

550,083. AUTOMATIC FLUID PRESSURE BRAKE APPARATUS; Robert A. Parke, New Brighton, N. Y., assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. Filed July 3, 1895. An automatic fluid pressure brake system, the release valve controlling the local release of fluid from the train pipe, the chamber formed on or secured to the valve and a piston fitting in the chamber normally held in position by fluid pressure and adapted when rapidly moved to effect a reduction of pressure in the chamber and open the valve.

550,102. UNDERGROUND TROLLEY SYSTEM; Cornelius J. Hamilton, Philadelphia, Pa., assignor of one half to James Lilley, same place. Filed April 26, 1895. In an underground trolley system a cover hinged to a suitable support, a lever hinged on either side of the cover and suitable counterbalances attached thereto in combination therewith, the chamber containing the feed wire and pivoted levers bearing sections of trolley wire arranged to make contact with the feed wires when the trolley wheel impinges thereon.

550,131. AUTOMATIC RAILWAY SWITCH; Herbert Peace, Lodi, N. J., assignor of one half to Cornelius Van Loon, same place. Filed April 8, 1895. In an automatic railway switch, a pivoted switch tongue connected suitably to a mechanical presser placed along the side of the track, which by the pressure of the wheel opens the switch when desired.

550,132. ELECTRICAL APPLIANCE FOR RAILWAYS; Herluf A. F. Petersen, Milwaukee, Wis. Filed March 19, 1894. An electromagnetic switch operated by two wires, the circuit being properly closed by the car.

550,220. ELECTRIC CAR OR LOCOMOTIVE; Rudolf Eickemeyer, Yonkers, N. Y., Rudolf Eickemeyer, Jr., executor of said Rudolf Eickemeyer, deceased. Filed April 8, 1891. In an electric car or locomotive, a motor having a casing which constitutes central, lateral and longitudinal portions of a motor frame and four frame extensions, each detachably coupled to the motor casing and embodying an axle box pedestal, said frame as a whole being adapted to spring mounting.

Electric Railway Gazette.

Vol. XIII. NEW YORK, DECEMBER 7, 1895. No. 23.

The Boston Subway.

In all great cities the progress of rapid transit, while materially assisted by improved electrical apparatus, is seriously impeded by the excessive crowding of thoroughfares. This difficulty is so universal, and one that is so frequently encountered by engineers, that the effort which is being made in Boston to solve the problem by means of a subway, cannot fail to be of much interest in street railway circles.

The Boston subway, which is now under construction, has for its aim the relief of the congested traffic on Tremont and Boylston Streets. Its route begins in the Public Gardens on Boylston Street, about opposite to the middle entrance, and proceeds underground along the edge of the Common and Public Gardens, parallel with Boylston and Tremont Streets. The work of construction is in progress as far up as Park Street Church, but it is stated that it will be extended to Scollay Square. The matter of building the subway through the Common and Public Gardens, while an engineering enterprise of the highest grade, is very much simpler than the construction of the remainder of the passage *via* Tremont Street and Scollay Square. It is necessary to do this work in sections and complete one section before beginning another, and the excavations have been boarded over so that the traffic will not be impeded. Aside from this, serious complications, due to obstructing pipes and other subterranean systems, have arisen. However, the first portion of the street system has been commenced and is being vigorously pushed. Fortunately the soil is of such a nature as to be free from liability to displacement by the enormous weight of the adjacent buildings. As the work progresses the levels of the buildings are frequently taken by the engineers, but up to date none has shown the least tendency to settle.

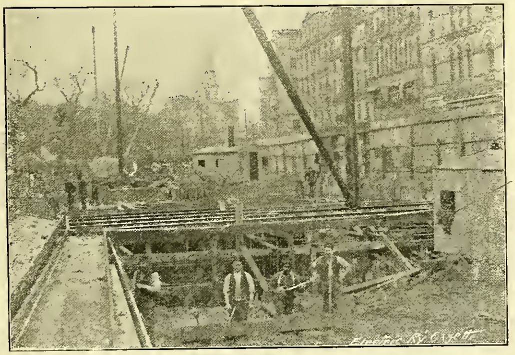


FIG. 1.—SHOWING IRON WORK UNDER CONSTRUCTION.

The subway under the Public Pleasure Grounds is being built in four sections, designated respectively as sections 1, 2, 3 and 3½. Section 1 includes that part under the Public Garden, and about three fifths of the passage on Boylston Street in the Common. It also includes a portion about the middle of the Tremont Street stretch in the Common. Section 2 comprises a length on Boylston Street and one on Tremont Street, the two adjoining at the intersection of these streets. Section 3 comprises the stretch from West Street to the Park Street Church, and section 3½ includes the portion on Park and Tremont Streets.

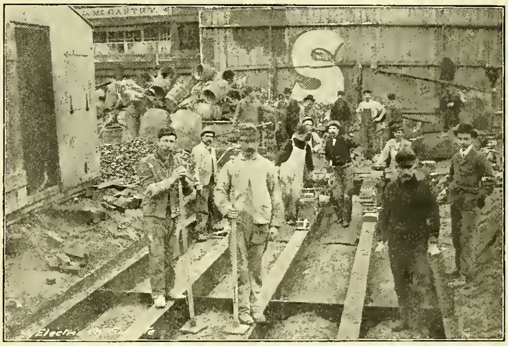


FIG. 2.—ARCHED TOP READY FOR COVERING.

The method of construction is very interesting; it consists broadly of excavating a huge trench, building an iron structure therein, filling in and regrading; the passage is too near the surface to resort to tunneling. The iron structure is built of I-beams and plate girders, which support brick and concrete arches. Under Charles Street, where the surface traffic is very heavy, beams are used which are made up of angle iron and plates, but under the public pleasure grounds, a 20-inch I-beam with a 7-inch flange is employed. The span is 24 feet and the spacing 3 feet. The section under the Common is a four-track passage, and therefore has a double span 48 feet wide with a line of supporting columns down the centre. The side columns are 15-inch I-beams with a riveted plate foot, and the middle columns are built up of angle iron and plates. Each column rests upon a solid founda-

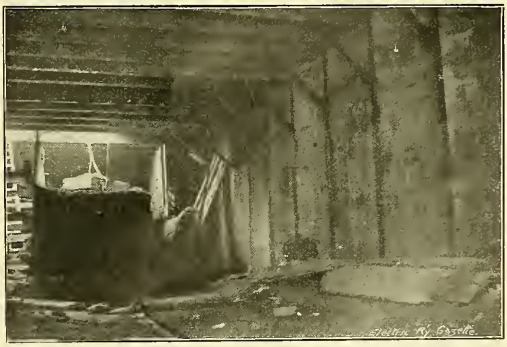


FIG. 3.—VIEW OF THE INTERIOR.

tion stone bedded in concrete. Fig. 1 gives a general view of the iron work. When the iron construction work is completed, wooden formers are placed between the I-beams to facilitate the construction of the brick arches, as shown in Fig. 2, and when these are well formed the remaining space is filled up with concrete and leveled off. The walls between the side columns are also arched to resist lateral pressure. Concrete only is used in the side arches, except for the portions under Charles Street and the Public Gardens, where the ground was found to be of a damp, clayey nature; in these places it was deemed advisable to use tiles in forming the vertical arches. Over 35,000 tons of steel has been used in the construction of the subway sections above mentioned; the steel is bolted together and hot-riveted in accordance with the practice of bridge constructors.

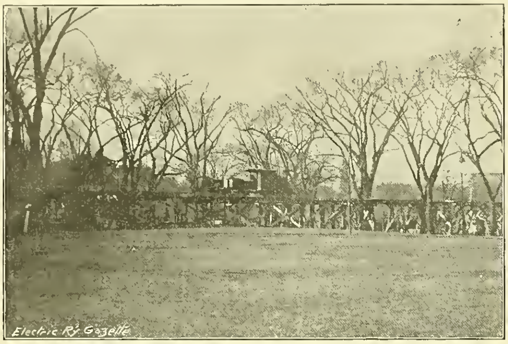


FIG. 4.—MINIATURE ELEVATED TRACK.

Fig. 3 gives a view of the interior of the subway. A round vitrified drain trench is provided which is connected at intervals to a 20-inch sewer three feet below which carries off the water. Before filling and grading over a complete section, the mass of concrete and iron work is given a coating of tar in order to exclude moisture. Contractor Everson, who is building Sections 2 and 3½, has attracted considerable attention by his ingenious methods of excavating and otherwise carrying out his contract, among these being the provision of a miniature elevated road to carry away the earth. The grade is quite steep, but the tiny locomotive draws four cars up it without trouble. A large power machine used in the mixing of concrete is another ingenious piece of apparatus; these two are shown in the accompanying illustrations.

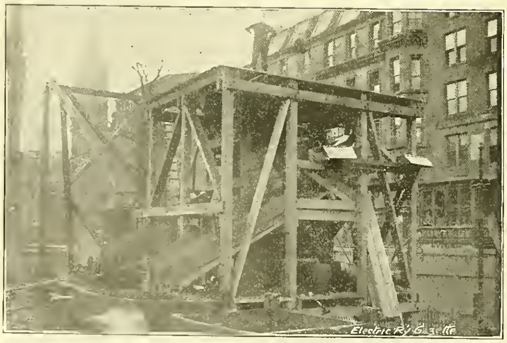


FIG. 5—CONCRETE MIXING MACHINE

Where Does the Relation of Passenger and Carrier Commence and End?

BY R. D. FISHER.

It is not yet settled whether the relation of carrier and passenger arises from a contract or from a duty which the law imposes upon the carrier of passengers. The weight of authority and good reasoning, so far as street railway traffic is concerned, is on the side of the latter theory. The adjudications are numerous that hold a street railway company liable where no contract existed, such as riding on the invitation of the conductor or driver, or riding by invitation and consent of the company. (Wilton *vs.* Middlesex St. Ry. Co., 107 Mass. 108; Philadelphia, etc., Ry. Co. *vs.* Derby, 14 How. U. S. 468.

If the relation is founded on contract, then it could not arise until the execution and proof of a contract. This contract is usually evidenced by the purchase of a ticket and placing one's self within the jurisdiction of the company's premises. If founded upon duty, derivable from the fundamental rule of society and government that in performing functions for the public, such care as the nature of the case admits must be exercised to prevent injury to another, then the relation would arise when the passenger properly came within that care which this fundamental rule imposes upon the carrier to exercise. If founded upon contract, the liability for personal injury should be contractural, and not based upon negligence or infraction of duty. If founded upon duty, then the liability is properly based upon a failure to perform that duty. Whether the relation is founded upon contract or duty, it is settled by a preponderance of the adjudicated cases that that relation will arise, *first*, before entering the carrier's car or conveyance; *second*, when a person is within or on the vehicle; and *third*, immediately after leaving or being ejected from the car or vehicle. A person can be within or on a vehicle or car and not be a passenger, as, for instance, when he is a trespasser. (Chicago St. Ry. Co. *vs.* Michie, 83 Ill., 427.)

No general rule has been laid down by which to determine when the relation will arise; but after a careful review of the cases, it is advanced with much confidence that, as a general proposition, the relation arises when a person has placed himself within the control of the carrier, been accepted as a passenger, and the risk begun. The three essentials, *control*, *acceptance* and *risk*, embodied in the element of duty, are incorporated in this proposed rule. This rule is applicable to both divisions, when on or not on the car.

With respect to placing one's self within the control of a carrier, it has been decided that the relation of passenger arises (1) before purchasing a ticket; (2) upon the purchase of a ticket; (3) while *en route* to the depot; (4) while waiting for the train; (5) during access to and egress from the vehicle or car.

First—Being upon the carriers' premises, depot, with *bona fide* intention of taking ensuing train, due within a reasonable time, although not having purchased a ticket, has been held sufficient in the matter of steam cars (Buffett *vs.* Ry. Co., 40 N. Y., 166). This proposition is too infirm, however, to apply to street railway traffic, except when regular stations are maintained. It cannot be said that the numerous stopping places along a line where passengers hail the trains, are premises under the control of a street railway company. If stations are maintained where the regular trip fare is required before entering, with a view to being transported, the moment one passes upon such premises he becomes a *bona fide* passenger, whether he enters the train or not. In such case, the elements of acceptance and the beginning of the risk exist, and the carrier may be held liable for personal injuries to those present without more. This doctrine rests upon the fact that the owner is liable for negligence in any insecure or dangerous condition the premises may be in, to persons entering thereon upon implied invitation for transportation.

Second—The purchase of a ticket and being present to take the car when it arrives, creates the relation of passenger; Wabash Ry. *vs.* Rector, 104 Ill., 296. (See Redfield on carriers, sec. 352.) This is the language of the court and book, but is far too inaccurate to apply to street railway service, because the elements of control, acceptance and risk are wanting. The language of the court is too loose for dependence, besides seldom would the facts in any given case justify such a broad dictum. The purchaser of a ticket standing upon a street awaiting a car at a place they they are accustomed to stop, is in no wise a passenger until accepted as such by an attempt to enter the car at the invitation of the carrier. If a street railway company invite the public to enter its cars at a dangerous and insecure place in the street, and one having a ticket attempts to do so, exercising the care commensurate with the risk, there is little doubt but a liability will attach, in case of injury, if it can be shown that the passenger had placed himself within the control of the carrier. The Georgia Supreme Court holds (58 Ga., 461) that one waiting for the train is a passenger after having purchased a ticket, and accepted as such. This doctrine will not apply to ordinary street traffic, as it is no part (except in rare cases) of a street railway company's duty to maintain safe streets or waiting places for passengers.

While waiting for the car, embraces that class of cases where the passenger is on the waiting station or platform, but in either case the elements of control, acceptance and risk must also exist. It has been held that being within the waiting room, waiting to take a car, was as effectual to create the relation as if within the car, although the injury happened upon the platform. The ground for recovery in this case, consisted in the failure of the company to see that all persons waiting to take the car were out of the way while the car was being turned, and that it was negligence to turn a car where so many eager persons were standing around it. The case was decided on the passenger relation, though the proper ground was negligence *per se*.

The mere stoppage of a street car, whether upon a person's signal or not, cannot create the relation, because there is no control, jurisdiction, acceptance or risk, and the cases usually cited to establish it do not support such a rule. A leading case rendered by the Minnesota Supreme Court (32 Min., 211), holds that the relation of passenger and carrier begins when a person is "in the act of carefully and prudently attempting to step upon the platform of a car." This holding is applicable to boarding, or attempting to board a car from the street, and not where stations are maintained.

Once accepted and within the control, the relation continues until the passenger has reached the place to which he is entitled to be carried, or to an intermediate point if desirable, and has had an opportunity, by safe and convenient means, to leave the car.

WHEN DOES THE RELATION END.

In a very recent case (32 Atl. R. 901) where it appeared that a passenger was being transported on a car, and upon her signifying a desire to alight, the car was stopped to enable her to do so, though at some distance beyond the place where she gave the signal. It chanced that at the place where the car stopped to enable her to alight, the side of the street sloped away into a ditch, so that the step down from the car to the earth was longer than usual, or than she anticipated, and consequently she lost her balance, fell and was injured. *Quere:* Had the relation of passenger ended?

The trial judge instructed as a matter of law "that it is the duty incumbent upon a common carrier to give passengers a place of safety for exit or egress from the car. If the place selected to stop the car under all the circumstances was not a safe place, and an injury received by her, while she herself was in the exercise of due care, then she is entitled to recover."

The Supreme Court held that this statement of the law applicable to street railways was incorrect. The question of care or negligence on the part of the company was entirely eliminated. No matter how great and painstaking the care and foresight of the company in this very matter of finding a safe place for alighting, the ruling rendered them of no avail. No matter how safe the matter may have appeared, no matter that there was nothing to indicate to the most prudent and vigilant conductor a lack of safety, the ruling held the company in fault. This was error. A street railway company, having no control over the street, is not an insurer of the safety of any place at which it stops a car for passengers to alight. If the company exercises proper care in its selection of a place, it is not in legal fault if the place proves to be in fact unsafe to one just discharged from a car. The company could not construct nor control any places at which passengers were to step on and off its cars. Passengers entering or leaving the cars had to use the streets in the condition they were left by the authorities in control of them. Such passengers were not in the care of the company till they got on the car. They were no longer in its care when they stepped off the car. The relation of passenger and carrier began when the carrier's control began, and ceased when its control ceased. Thus, where a person has placed himself within the jurisdiction and control of the carrier, accepted as a passenger and the risk begun, the company must exercise extraordinary care, its instrumentalities being dangerous, to safely transport, and as a logical conclusion, the means of egress must not only be reasonably safe, but as safe as human foresight can reasonably be expected to make them; but in no case will a company be held as an insurer of the safety of the street for passengers to light upon.

Electric Railways in Dublin.

The directors of the Dublin United Tramways Co., of Dublin, Ireland, have just returned from their visit to the United States for the purpose of inspecting electric railways. They have been so convinced of the value of the overhead electric system that the company upon their recommendation will apply for franchises enabling it to build an extensive electric railway system. The Dublin & Southern Electric Tramway Company is applying to Parliament for powers to construct a comprehensive system of electric tramways in the city and suburbs of Dublin.

New York City Street Railways.

The committee of the New York State Legislature appointed to investigate the subject of street railways has been occupied principally during the present week with the Metropolitan and Third Avenue Companies, of New York City. Mr. Herbert H. Vreeland, president and manager of the former, who was before the committee on Dec. 4, explained that his company was formed May 28, 1894, by the consolidation of a number of small companies whose tracks aggregated nearly 140 miles in length. About 33 miles of road are now operated by cable and electricity, the latter being employed on the Lenox Avenue line. Mr. Vreeland stated that the electrical system they have now in use is largely experimental, but that if the line works successfully this Winter, it will be extended to all the lines of the company not now equipped with cable.

The Metropolitan Company has now 300 cable cars in constant use and about 650 horse cars, employing in all nearly 2800 men. On the Broadway cable line the men work 9¼ hours a day, one hour being allowed for lunch. Six round trips constitute a day's work for a gripman, for which $2.40 is paid, but extra trips usually bring the earnings up to $17.50 a week. Mr. Vreeland stated that the entire service is governed by civil service rules and that a system of rewards by promotion and increase in pay has had a good effect on the men. Applicants for situations are examined carefully as to sobriety and integrity. Of the 500 gripmen employed, only eight left the company during the months between May and October, six of whom were discharged for drinking, which the company will not allow. Mr. Vreeland said that the question of conductors was a more difficult one, nearly 100 being discharged every month "for neglecting to register fares." He considered that vestibuled cars are utterly impracticable in a crowded city like New York on account of the frosting of the glass in Winter, preventing the gripmen from seeing plainly. The Metropolitan issues about 80,000 passes each day on all its lines, representing about $1,500,000 a year in fares. Last year the company carried 140,000,000 passengers, and, in addition, 30,000,000 were transferred.

The Metropolitan Street Railway Company has a capital of $16,500,000, and a bonded debt of $9,400,000. It paid $439,993.07 in taxes last year, and its gross receipts were about $6,000,000. A dividend of 3 per cent. on the stock was paid, and the interest at 5, 6 and 7 per cent. on its bonds. The company leases the following lines: Broadway & Seventh Avenue, $835,000 a year; Twenty-third Street line, $193,000; Forty-second Street & Grand Street ferry line, $148,800; Central Park, North & East River, $228,000; Sixth Avenue, $145,000; Ninth Avenue, $50,500. The company's real estate is valued at $3,500,000.

On Wednesday, Mr. Edward Lauterbach, the counsel of the Third Avenue Railway Company, appeared for President A. J. Elias, who was unable to attend on account of illness. Mr. Lauterbach said that the road was chartered in 1853, with a capitalization of $2,000,000, and bonded for $2,000,000, all of which represented cash expenditure. In 1887, the capital was increased to $9,000,000, all of which except $200,000 represents cash expenditure. The company now operates 387 closed cars on 14 miles of double-track road. It was the first road in New York to adopt the cable, which was first used on Tenth Avenue between 125th and 186th Streets, where there is a very severe grade. Last year the fares paid amounted to $2,583,011.17. The operating expenses were $1,500,000, and taxes and interest amounted to $330,589.81. Dividends of 9 per cent. were paid.

Mr. Lauterbach introduced an argument in favor of watered stock, which, he contended, injures nobody. "No one is obliged to buy it, and there is no law compelling anybody to invest in it." He considers that, owing to the tremendous risks involved in building railways, they would never be undertaken unless there was an opportunity for great profits. He considers that legislation providing for a better way of disposing of franchises is much more important than legislation against watering stock.

Mr. Lawson N. Fuller, who represents the elevated railway interests, followed Mr. Lauterbach as a voluntary witness, and gave some interesting and lively testimony.

"I was the first man," he said, "to advocate the cable system in Broadway. I was also in at the beginning of the L roads. Cyrus Field sent for me one day and told me he could get a controlling interest in the then unbuilt L roads for $150,000. He asked me if I would put in my services in lieu of money until the road should be a fact. I knew that Mr. Field had got Peter Cooper, Marshall O. Roberts and Morris Taylor to put in $50,000 each. Mr. Taylor backed out after a while, saying that he might as well throw his money into the North River as to put it into an elevated road. All the others then backed out, except Mr. Field, who said:

"'I'll make a million and a half out of this road, or I'll lose $150,000. The people may say I'm a damned fool, but I'll go ahead.'

"He did go ahead, and it is a fact, not generally known, that Mr. Field made all of his money in the elevated road and lost it all there."

Mr. Fuller said that the introduction of rapid transit facilities in the Twelfth ward had increased the value of property there $142,000,000 in twelve years.

In speaking of the underground railway plan Mr. Fuller said:

"If this scheme goes through it will be the greatest outrage ever perpetrated on any people. It would cost $55,000,000, and nobody would ride on it when it was finished. What we people of Harlem want is an extension of the elevated railway, and the cable and underground trolley system. I went at the request of Melville Smith, Russell Sage, Cyrus Field and Jay Gould, and asked them to put some money into an underground scheme, or to allow the use of their names and influence. Mr. Gould said:

"'Friend Fuller, I can buy underground systems cheaper than I can build them.' The others said: 'Not a cent! Not a cent!'

"Jay Gould understood the transit problem in New York better than any other man. He was worth any ten living men on such matters. Had he lived until now, we should have had an L road to Fort George two years ago."

When asked what the Rapid Transit Commission had done, Mr. Fuller said:

"Done? Why, they've spent $3,000 in paper drawings. That's all they've done. I've nothing to say against the members of the Commission. Take Seth Low—he's a gentleman and a scholar—a perfect living picture. Mr. Starin is a good man. He knows all about tugboats. Mr. Orr has a lovely whisker. The trouble is they don't understand the transit question. What does a piano man know about rapid transit? I think the most level-headed man on the Board is John Claflin, and I also believe that if you could get his honest opinion you'd find it to be that the Commission is a farce. That's what it is—a fraud and a farce. Why? Governor Flower himself told me that, though he had to sign the bill creating the Commission, he voted against it. I came downtown yesterday with ex-Mayor Gilroy. He said to me: 'That underground scheme is the damnedest fraud in existence.' It's a mistake to suppose that the elevated road people are worrying about that underground road. They know that if it is ever built they will buy it at ten cents on the dollar, and use it to carry freight and garbage."

The Proposed Deal in Brooklyn.

It is stated that Tom L. Johnson is about to effect another big street railway consolidation, this time in Brooklyn, where the ex-congressman and his brother, A. L. Johnson, control the Nassau Street Line. It is said that the Nassau road has secured a lease of the Brooklyn Traction Company's line, and that this deal is a forerunner of a complete consolidation of the Brooklyn lines into one system under the Johnson management.

The leasing of the Atlantic Avenue Railway system, which is owned by the Brooklyn Traction Company, to the Nassau Electric Railway is not yet an accomplished financial fact, but it is considered as beyond doubt that it will be carried through to a satisfactory completion. Up to the present time the utmost efforts of counsel for the Nassau Electric Railway Company have not resulted in more than the completion of the draft of the lease, which has not yet been submitted to General Tracy, who is counsel for the Brooklyn Traction Company in the matter. After he has scrutinized it in a legal way the question is to be voted upon by the holders of the securities of the Brooklyn Traction Company. The terms of the draft of the lease are said to be such that the property is to be turned over to the Nassau Electric Railway Company free and clear of floating debt. The money realized from the lease by the Brooklyn Traction Company will be used in paying the fixed charges, amounting to nearly $300,000, and a dividend on the preferred and common stock.

It is said to be the plan of the controlling interest in the Brooklyn Traction Company to get rid of the preferred and common stocks of that company by the organization of a new company. The plan, as announced, provides for a new company with a capital of $4,500,000 common stock instead of $6,000,000 preferred and $6,000,000 common, as the present Brooklyn Traction Company is capitalized. The holders of the old preferred stock are to exchange share for share for the new, and the common four shares for one, after paying a 2 per cent. assessment.

It is said that there will be an alternative proposition so that common stockholders may pay 7½ per cent. assessment and receive at par 5 per cent. bonds of the Brooklyn, Bath & West End Railway, now in the treasury of the Atlantic Avenue Railway Company. For the first year the stock given in exchange for the preferred stock is to receive 3 per cent. and that given in exchange for the common 2 per cent. After that 4 per cent. is to be the dividend on the entire $4,500,000. The reason for that is that the rental to be paid by the Nassau Company increases after the second year.

While this plan has been indicated as the one which is most likely to be carried out, there is no doubt that it is subject to change in a good many particulars. The wishes of the stockholders will have to be consulted to some extent, and for that purpose a meeting is to be held shortly. If it is found that the plan, the outlines of which are stated, can be carried out without much opposition, then it will go through in that way. It is expected that there will be some objection to the plan of levying an assessment on the common stock unless a very satisfactory explanation of the use to which the money so raised is to be put can be made.

The plan to lease the Atlantic Avenue Railway system is characterized in Cleveland, where Congressman Tom L. Johnson resides, as a deal contemplating the purchase of the franchises and what roads the Nassau Company has built, the combination of the Brooklyn Traction and Nassau Companies, and a general reorganization. It is also thought in Cleveland that an effort will then be made to bring pressure to bear on the Long Island Traction Company with a view of forcing it into the combination, thus giving complete control over the Brooklyn Street Railways.

While such a plan is feasible, it is not thought here that there will be any reorganization which will result in the absorbing of the Nassau Electric Railway Company. It is, however, deemed more than probable that there will be some plan in the future by means of which an attempt will be made to force the Long Island Traction Company to surrender to the Nassau combination.

Brussels Street Railway Fares.

The ways of the street cars in Brussels are droll beyond description. In the first place you have to keep your ticket so it may be punched by the *controleur*, who is sure to pounce in on you just when you have forgotten where you have stowed it. A recent visitor to the Belgian capital says he was recently initiated into the knowledge that on all the open cars of one line, the four front rows are "first-class," *i. e.*, you pay five centimes extra. Not that these seats are any more comfortable, like those in the closed cars, where the front end is cushioned and divided off; for when the car returns the backs are flopped over and the first-class seats become second class, and *vice versa*. To his surprise one Sunday morning, upon climbing into the *rear* seats, he was charged five centimes extra and referred to a sign (put up only the day before and looking just like the old one), to the effect that the *four* rear seats were first-class. Experience having been gained at a cost of one "sou," in the evening he made for the *front* seats of a car of the same company, and was surprised to find that on that avenue, as of old, the front seats were first-class.

In the evening he started out to find an alleged American or English church in the Rue Washington out by Rond Point—and it was not there. Being tired and wanting to ride back, and as all the cars were "complet," coming from the Bois, he decided to get in a car *to* the Bois and stay there, so as to be sure of a seat coming back. When near the depot he was ordered out, as no one is allowed to enter the "remise" or car-barn. Being a good scrambler he finally got a "stand-up seat" on the rear platform of another car.

A Street Railway Flurry in Philadelphia.

A mass meeting was held in Philadelphia at the Academy of Music, on Thursday of this week, to protest against the alleged discrimination of the Union Traction Company in its rates of fare. About 5000 people were in attendance, whose attention before the opening of the meeting was attracted by a large placard intended to illustrate the discrimination of this corporation against certain sections of the city. The placard bore two dark lines, one twice as long as the other; the shorter one represented the ride from Frankford to Columbia Avenue, for which the fare is five cents, and the longer one, the ride from Germantown to Snyder Avenue, for which five cents is also charged.

Ex-Postmaster Field nominated Mr. Thomas Martindale as chairman. In opening the meeting Mr. Martindale charged the Traction Company with injustice toward employees and toward the people, and denounced the consolidation of the lines which resulted in the formation of the Union Traction Company. He prophesied that should that company not come to terms, there will be a fight for municipal control of the streets, and in the end the movement for three-cent fares and five-cent transfers will result successfully. A number of letters were read from organizations, and then Mr. Charles Emery Smith was introduced. He charged that the Union Traction Company has seized upon concessions to create a joint monopoly which has undertaken to levy an additional toll of 60 per cent. upon every rider "who in our city of right angles has occasion to turn a corner." He characterized this increased tax as a great and unendurable wrong, and said that the people proposed to fight it to the bitter end.

Ex-Gov. Patterson was the next speaker, and said that the grievance for which a remedy is sought is against those who have been given large powers over streets and highways, and declared that the passage of the act giving authority for consolidation was in violation of the spirit, if not the letter, of the Constitution, and is certainly against a sound public policy. While conceding the right of capital to a fair earning, he stated that the fare is getting beyond the reach of the people—which is the present grievance—and calls upon the managers of city railways for the restoration of the old fare system, assuring them that by so doing they will receive cordial sympathy and appreciation. Senator Penrose in the course of some remarks said that the people of the city cannot be safely left to the mercies of the traction monopoly, and should demand in unmistakable terms that the next Legislature pass the necessary laws to permit the construction of elevated railways, which he considers to be necessary in view of the present monopoly of the streets by the Traction Company. He recommended that all candidates for election to the Councils should be pledged to vote for such an ordinance as will compel the company to furnish the public the accommodation and facilities to which they are entitled, to reduce the fares and to compel the city authorities to enforce the existing ordinances.

Mr. Samuel Grothers denounced the consolidation act and called upon citizens to put men in the Councils who will vote for the purchase of the street railway lines under the clause inserted in the railway franchises, enabling this to be done. Rev. George D. Baker said: "Some day when we own ourselves, we will own our railways. Before that time we will have a just fare. And while we wait for that—let's walk." Rabbi Krauskopf in his remarks said that he is not so blinded by disapproval of the Union Traction Company's apparent impositions as not to see the service they have rendered, and still render, the city, and though he much deplored that its managers "should wantonly strip themselves of their glory by seeking now to make themselves a second time paid—the first time by a most liberal franchise; the second time by the extortion of a larger fare." Mr. J. Morton Eldredge advocated the purchase of the roads by the city, and a change in the Councils would enable this to be done.

Resolutions were carried charging that the Union Traction Company, by the abolition of free transfers and the imposition of a fare of eight cents for service formerly rendered for five cents, has shown itself indifferent both to the comfort of its patrons and to the force of public opinion. The resolution protests against this increase of fare and the abolition of free transfers, and demands the restoration of the free-transfer privileges formerly enjoyed on the combined lines of the Electric & People's Traction Company, and the lines of the Philadelphia Traction Company, and the extention of these privileges to all lines now included by the Union Traction Company. A committee of citizens was appointed to wait upon the managers of the company to urge the above considerations.

Taxing Improvements.

To the Editor of the Electric Railway Gazette:

Sir: Your editorial in the Electric Railway Gazette of November 2, on "Taxation of Cars," interested me. Here is certainly a sample, not of unjust taxation according to law, but of unjust law regarding taxation. Let me ask, who have been benefited by the generosity of the railway company? You would naturally say, the people. But let me ask, what would property, four, six or even ten miles from the business or workshop portion of the city be worth if there were no street railways? Does not the extension of these roads increase the rental value of the land, whether improved or unimproved? Why should not those benefited, and they are the land owners, pay the tax? Why should the company, because they have seen fit to give the people the best accommodation within their means, and spend thousands of dollars to be idle a good portion of the year, be fined, or in other words, taxed for their generosity? They surely should not, but under the present system of taxation it is unavoidable, and those most benefited only can escape just taxation. This present system of taxation is a barrier to improvements and should be abolished. If one should wish to make his wife or daughter a present of a piano, he will stop and think, "Well, I will be fined for it not once, but every year," and at the end of ten years he has paid for it twice. Will he not hesitate before he ventures? Yes. Do not street railway companies hesitate before entering an unsettled portion of a city to accommodate a few, for the same reason? Put your tax on land values, and let improvements go free of taxation, and then, and then only, can justice be done. There is doubt in my mind that with a just method of taxation, improvements would be made that would consume all the idle labor in the community, but under the existing conditions of taxing every improvement, the barrier is too great to be overcome. Hence, many idle men with no conveniences, while others have abundance, and the land owner receives the harvest.

Albert Blanchard.

Street Railway Engineers—XXVIII.

GRANVILLE C. CUNINGHAM, M. I. C. E.

Visitors to Montreal in attendance on the recent convention of the American Street Railway Association, found much to interest them in the way of engineering novelties forming part of the Montreal Street Railway. The type of rails used, the method of tracks without ties and other features gave evidence of engineering progressiveness united with a high order of professional competency.

Mr. Granville C. Cuningham, to whom credit is most largely due for the excellent technical standing everywhere of Montreal Street Railways, learned the profession of civil engineering in Edinburgh, Scotland, and, on leaving his native land, in 1870, first went to Honduras, in Central America, and was engaged for some months on a projected railway in that country. Since coming to Canada, in 1871, his work has been largely connected with the chief railway schemes of that country.

In 1889 Mr. Cuningham was appointed assistant city engineer, and afterward city engineer of Toronto, Can., and it was then his attention was directed to electric street railways. In 1891 Toronto was about to introduce an electrical system, and Mr. Cuningham was required to visit the various cities of the United States and report to the City Council upon the best system to be adopted in Toronto. It was upon his report that the system now established there was introduced. In 1892 Mr. Cuningham was appointed chief engineer of the Montreal Street Railway, and the work of converting that system from a horse to an electrical one has been carried out under his direction. In 1893 he was appointed manager and chief engineer of the Montreal Street Railway, which position he now occupies.

In 1878 Mr. Cuningham was elected a member of the Institute of Civil Engineers, of London, England, and he was among the first members of the Canadian Society of Civil Engineers. He has served as a member of the Executive Committee of the American Street Railway Association, and at the Montreal meeting this year was elected first vice-president of that body.

GRANVILLE C. CUNINGHAM.

To Meet Trolley Competition.

At the twenty-fifth annual meeting of the American Society of Railway Superintendents, Col. H. G. Prout made an address on "The Use of Electricity as a Motive Power on Railways Now Operated by Steam." In the course of his address he spoke of the competition of electric roads and referred to the gravity of the situation which now confronts the railway companies in the matter of suburban and interurban traffic, a large share of which must inevitably go to the electric railways. It was suggested, however, that there are steps which can be taken by some of the railways which may prevent the loss of business. Some railways, for instance, may be able to equip two tracks for electric operation within their suburban zones on which very frequent and light trains can be run, stopping often. Semi-express trains, to serve the more distant suburban, points could perhaps be operated on these tracks. There are other railways which may be able to acquire new lines and equip for electric operation. A great many others can hope to postpone for a little while loss of traffic by giving better suburban service and perhaps lower rates. On some roads accommodations could be made more comfortable for passengers by furnishing better lights, better heating, better cars generally, better facilities at terminal stations, more trains, and a quicker schedule.

Mr. Gould on Rapid Transit.

Mr. George J. Gould, president of the Manhattan Elevated Railway Company, was a witness on Thursday before the Assembly committee investigating New York City railways, and in reply to a question as to what he regarded as the most feasible system of transit for New York, said that he thought an elevated road equipped with electricity presented the most advantages. Experiments with electric traction, he added, would probably soon be made on the annex road. Mr. Gould expressed great solicitude for the safety of the patrons of his road and did not wish to adopt electric traction until it had passed the experimental stage.

Mr. Gould expressed himself as being opposed to government ownership of railways, but, unlike Mr. Lauterbach, in favor of legislation to restrict the evil of stock watering. Capitalists would not invest in hazardous enterprises unless some other inducement besides a 6 per cent. dividend was offered them. Mr. Gould thinks the proposed underground system is possible, but would not be profitable. He doubts whether the people would like it, and naturally he regards elevated railways as the best system of rapid transit. Asked as to the policy of municipal ownership of railways, Mr. Gould said: "I don't think that is a proper thing for the government to take up. It is a move towards Socialism, and I think it would result, if put in practice, very disastrously. A government railway is never so carefully run, from a financial point of view, or a public point. for that matter, as a private corporation. The thing has been tried in Europe, and doesn't pay. It is the same with telegraphs. The postal telegraph in England has never paid. I am very much opposed to government going into any business enterprises. They should be left to private capital to develop, and whatever risks there are in the business private individuals have to meet it, and not the government. We tried, in a way, government ownership on the Pacific Railways; but the government, instead of owning the roads, loaned them its credit. It turned out disastrously, not only for the government, but for the railways as well." Mr. Gould was also asked whether he considered it good economy for the laws to make transit companies a source of public revenue. "I believe," Mr. Gould said, "they ought to pay their fair proportion to the State."

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ELECTRIC LOCOMOTIVES.

Up to date no electric locomotive has been constructed on radically different lines from the ordinary motor car as regards arrangement of parts. For freight shifting and kindred working, such changes are not particularly necessary. However, there is a time coming in the near future when the electric locomotive will be called upon to perform high-speed passenger service on short branch lines. The public will critically regard the first attempts. Why then is it necessary to place the motors in such an inaccessible position as is now common practice? It is a perfectly simple matter to build a locomotive cab so that the motors or their essential parts will be at all times under the immediate supervision of the engineer. The great success of lighting installations is due almost entirely to this feature. On an electric locomotive designers are not limited by passenger accommodation, as in ordinary motor cars. They have all the room there is. The engineers of the fast flyers have a chance to partially overlook the running of their engines, and we frequently see them climbing along the narrow platform when the engine is running at full speed. Why is it not possible to vastly improve an electric locomotive in this respect?

MOTOR STARTING RESISTANCES.

Why is it that the resistance used in the starting of motors on street railway equipments is invariably kept under the car body? The heat developed in this resistance is often no inconsiderable amount, especially when series-parallel control is not used, and could be very advantageously used in heating the car. Its presence inside in Summer time need be no obstacle, for it can readily be incased in a box with two slides, one opening on the outside of the car and one on the inside. In the Summer time the former could be removed, and in the Winter the latter. A little ingenious distribution of the resistance would do much to produce a beneficial result. At present the car is heated by electricity, by means of resistances absorbing a few amperes at full 500 volts. The motor uses current of much greater volume, and often as much as 200 or 300 volts are taken up in the resistances. This means a number of watt-hours fully equal to if not greater than is required by the electric heaters. If desired, a system of heaters could be designed which the motor would use as starting resistances, and by a double-throw double-pole switch the current could be turned on to resistances under the car in Summer time. On suburban lines this practice would not be beneficial, but in crowded city traffic it is worthy of serious consideration.

DEFINITE STOPPING PLACES.

In spite of the fact that the value of definite places at which to stop the cars of a street railway is so plainly apparent, there are many roads that pick up a passenger wherever he may hail the car. In order to obtain the greatest amount of business the managers of a company must seek to please the greatest number. While these promiscuous stops are extremely convenient for the one or two parties getting on the car, they are equally annoying to those on board, and the latter are the majority. Some people take a street car to save their strength, and others to save time. If the saving of time is materially diminished by those frequent stops, the latter class of fares are lost. It is said to cost 35 cents to start and stop a steam locomotive, and the cost of starting and stopping a motor car is an item of importance. Definite stops also insure accurate running time and systematic management. In the face of all these facts this principle of economic running is frequently and deliberately violated. False economies are frequently practiced in a station. Many managers think that a cheap engineer is a paying investment, and they never think of paying for an expensive fireman. The roads that practice such economies are invariably those that follow this principle of grabbing a nickel wherever it may be gotten. System first, last and all the time, is the only principle on which an electric road should be operated.

SUBWAY CONSTRUCTION.

Crowded streets in large cities forbid rapid transit and largely increase the liability of accident to persons and property. Any method that will obviate the difficulties incident to such congested thoroughfares is to be looked upon with favor. While the subway construction, which we describe in another column, is undoubtedly very expensive, it has certain merits that will enable it to win its way where an elevated road, owing to popular opinion, would be impossible. The value of real estate abutting a subway will be enhanced, whereas elevated roads deteriorate the value of property. It is to be remarked, however, that subway construction can only be pursued under certain favorable circumstances. The pipes, sewers and other subterranean obstructions often present a difficult problem, which, in some of the streets of a great metropolis, would be well nigh impossible of solution. It is not always possible to take a short cut across or along a public pleasure ground. It is also to be noted that in cases where the ground is of a soft yielding nature, or the land is reclaimed swamp land, as is often the case, excavations as extensive as this construction involves greatly endanger adjacent buildings. It is not a universal method of meeting the difficulty mentioned, but it is one of the most desirable special methods to be employed when circumstances permit.

THE SPREADING OF A FAULT IN HIGH VOLTAGE FIELD COILS.

It is a fact well-known among designers that the magnetizing power of a shunt field coil supplied at constant potential, depends, not upon the number of turns, but solely upon the gauge of the wire and its conductivity, provided temperature and average length of turn remain fixed. The only effect of cutting out coils by short circuiting is to increase the heating of the others. Therefore, a bruised insulation by which a few coils are cut out, may pass unnoticed, but the bobbin heats more in the other coils. The fault rapidly spreads after once having gained headway, and may proceed completely through a bobbin, thus causing dangerous heating by the entire voltage on the remaining coils. It is always a wise precaution to test the resistance of field bobbins to see that it remains the same. This can be readily done by placing a low reading ammeter in the shunt circuit, and running the machine at exactly 500 volts, or some other reference potential. Any increase in the ammeter reading above the usual value indicates trouble of this nature, provided the coils are approximately at the same temperature at the time of each test. The defective bobbin can be readily found from the fact that a voltmeter applied to its terminals will have a less deflection than if similarly connected to the other bobbins. Occasionally a dynamo will be found that has shunt bobbins of widely different resistance, either beause they are wound with a different gauge of wire, or a copper of different conductivity. In such cases this latter test will not apply, but this is the exception and not the rule.

Union Traction Company of Newark in Trouble.

The Union Traction Company, of Newark, N. J., which was organized only a year ago, and capitalized at $1,500,000, has been enjoined from collecting debts or transferring stock and placed in the hands of a receiver for a debt of $166.66, due Luther Shafer, of Rutherford, for office rent. At the time of the incorporation of the company $25,000 was deposited with the Secretary of State, together with a route map, showing that the company proposed to build a trolley line from Newark through Kearny and Union townships to Hackensack.

Franchises and the right of way for the full distance had been secured by March 25 last, the terms of the ordinance being that the company should begin to construct its line within 60 days. It was also stipulated that a bond of $5000 should be filed with the authorities of Rutherford. Mr. Shafer declares that the bond offered was rejected because of the insufficiency of securities, and that the company mortgaged its franchises and property for $1,000,000 to the Metropolitan Trust Company of New York.

Union Traction Defended.

At the regular meeting of the Kensington Reform Club, of Philadelphia, on Saturday last, a paper entitled "A Defense of the Union Traction Company," was read by John L. Walsh, a clerk in the office of the Recorder of Deeds. In it the Union Traction Company was referred to as a public benefactor and the developer of Philadelphia, and the improved pavement cited in proof of the assertion. In it the speaker said the good faith of the Philadelphia Traction Company was shown by the fact that, after spending millions upon the cable roads, it had no hesitancy in introducing the electric system.

"We have," continued Mr. Walsh, "brilliantly lighted and well heated cars running over well paved streets, all done by the so-called soulless corporation." He called attention to the fact that the company gave employment to many thousand men, and paid an enormous amount in taxes into the city treasury, and he expressed the conviction that the 8-cent exchange system entailed no hardship.

A New Conduit Railway System.

Letters patent have recently been issued by the United States and Great Britain to J. E. Parker, No. 1 Broad Street, New York City, for a rather interesting conduit railway, which we illustrate herewith. The conduit is built up of a simple rectangular trough and flat slot rails, shown in Fig. 2, which are supported by iron frames, one of which is shown by Fig. 4. Fig. 3 gives a cross-sectional end view of the conduit, which, in practice, is set on the ties, midway between the tracks, and spiked down. The conduit trough is 18 inches deep, and about 15 inches wide, and is made in sections of any convenient length.

The cross bar of the iron frame, Fig. 4, is located some distance above the floor of the conduit, so as to keep the insulator which supports the conductor well out of the reach of slush, etc., which may collect in the trough. These iron frames are located at such intervals as to give the structure proper rigidity The conductor rests in a slot in the top of the insulator, above which it projects about an inch. (See Fig. 3.)

The trolley is shown by Fig. 5, and is of the simplest construction. It consists of a forked arm projecting downward from the car, as shown in Fig. 1, and carrying an ordinary trolley wheel in its bifurcated portion. The trolley arm is provided with a trolley guard, also shown in Fig. 1, consisting of two metal bars extending down from the car, and carrying a flat horizontal bar, which is slotted in the centre. In this slot is placed a wheel which runs in the slot of the conduit ; the trolley arm also passes through the horizontal bar, by which it is protected from scraping against the edges of the slot rails.

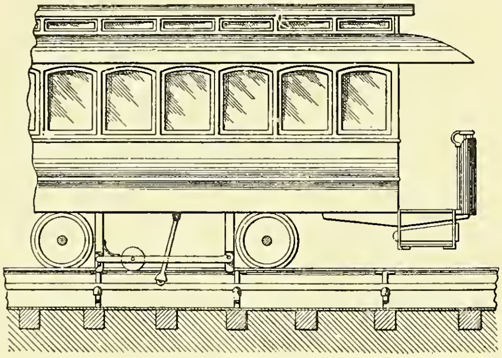


FIG. 1.

The conduit trough is used as the return conductor instead of the track, and the trolley guard frame just described fulfills also the function of an electrical connection between the motors and the underground trough. The trolley arm is thoroughly insulated from the wheel and from the conductor leading up from the trolley wheel to the car, so as to avoid a short circuit between the conductor in the conduit, which is electrically connected with one terminal of the station generator, and the conduit trough, which is connected with the other generator terminal. The inventor lays much stress upon the fact that by reason of the use of the trough for a return conductor, that side of the circuit is effectually grounded.

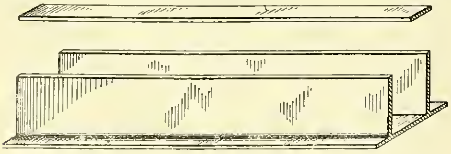
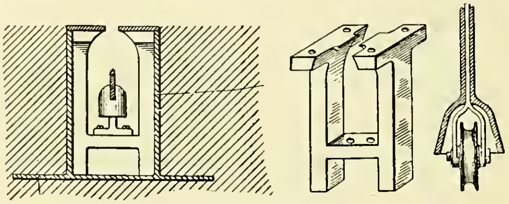


FIG. 2.



FIGS. 3, 4 AND 5.

A simple mechanical device (not shown in the illustrations) is provided, by means of which the motorman can reverse the angle of the trolley arm when the direction of the car is reversed, so that the trolley will trail.

One of the advantages claimed for the arrangement is that the slot rails may be readily removed without disarrangement of the paving, affording quick and convenient access for inspection, etc. The trough is connected at short intervals with a sewer, so as to minimize the accumulation of objectionable deposits in the conduit.

Comments and Views of Contemporaries.

Passing of the Cable System.—The passing of the cable means the loss of a great deal of money. In St. Louis two cable roads have been torn up and the rails and remnants sent to the scrap heap. The engines and machinery were sent to the junk dealer. Cable tracks cost from $50,000 to $60,000 per mile. A million-dollar road is by no means a very large one. If all the mileage in St. Louis were cable it would represent a couple of billion of dollars. The cost is prohibitive. This shows that electricity came in the right time. If it had been delayed there would not now be 13,000 miles of street railway in the United States.—*St. Louis Globe-Democrat.*

The Beneficent Effect of Trolley Roads.—Electric railway extension in West Chester County and the development of the county are progressing hand in hand. In nearly every quarter of the half of the county nearest New York, electric lines are either projected or in actual operation. Particularly of benefit to the county, in the respect of adding to its population, are those lines which connect it with New York, and which can be used by commuters in going to and from the city. One of the most important of these lines, which is within a few weeks at most to establish a connection between this county and New York, is the branch of what is known as the "Huckleberry" line, which is to run from New York to Yonkers by way of Eleventh Avenue, the Kingsbridge road and South Broadway. When the line is finished it will be possible to ride from Getty Square, Yonkers, to New York for 10 cents. It will render Yonkers and the intervening territory very accessible and attractive to home-seekers. The man who in this day does not appreciate and properly value the importance of the electric road as a factor in the expansion and progression of this county, is lagging away in the rear of the procession of intelligence.—*White Plains, N. Y., County Reporter.*

The Lombard Fluid Brake.

The need of a reliable power brake for electric street cars has been recognized for some time past, and numerous attempts of more or less merit have been made to meet the conditions involved.

Appreciable disadvantages frequently attached to the use of power brakes are the complication and exposure to dust, etc., of the mechanism, resulting in frequent repairs, and introducing an element of unreliability which militates seriously against the use of such apparatus.

With these facts in view and impressed with the value of a power brake devoid of the disadvantages mentioned, the Lombard Water Wheel Governor Company has perfected the power brake apparatus shown in the accompanying engravings.

Fig. 1 shows the box, which is about 30 inches long, 12 inches wide and 8 inches deep, containing a piston and pump cylinders, and connected with the pressure tank. This tank is about 38 inches long and 6 inches in diameter, and the whole apparatus weighs about 150 lbs. The box may be placed anywhere under the car floor where the sprocket wheel can be connected with the axle to get power to drive the pump. The tank is placed preferably under the car seats, where it can be conveniently reached by piping to connect both ends with the box containing the brake and pump cylinders. This tank is partitioned into two chambers, the larger chamber is filled two-thirds full of oil and charged with air compressed to about 220 lbs. pressure. The smaller chamber is practically a vacuum. A safety valve is placed on the pressure end of the tank. The pressure gauge may be placed anywhere upon the car. The oil is admitted to the brake cylinder and controlled by a three-way valve operated by the motorman and automatically closed by the upper rod (Fig 2) as soon as the brake has acted.

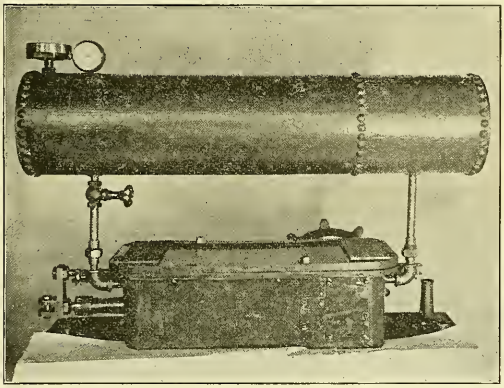


FIG. 1.

Fig. 2 shows the interior arrangement of the box containing the valve-operating mechanism. It will be observed that the sprocket wheel is mounted on a short shaft having a small crank connected to the piston rod of the pump by means of a fork connecting-rod, giving a reciprocating motion to the piston. The piston and valves are so arranged as to make it a single-acting pump. The brake-operating piston, the upper of the two, having a rod projecting outside of the casing, has a coupling on one end to receive the brake chain. Any movement of the piston will operate the brake lever and so set the brakes of the car. It is also connected with the valve by the rod located alongside of it. This piston and its rod may travel 10 inches and is 2½ inches in diameter, taking 18.84 cubic inches of oil or about one pint to fully extend the brake rod. The lower of the two rods operates the three-way valve which controls the setting or releasing of the brakes, and is operated by a handle at either end of the car. Pipe connections at each end of the box are provided to receive the pipes connecting with the tank, forming a closed circuit for the fluid to pass from the pressure tank through the brake piston, setting the brake and exhausting into the vacuum, then being pumped back into the pressure tank by a few strokes of the pump. The piping is so arranged that only oil and never air enters the brake cylinder. The iron casing is partly filled with lubricating oil and closed tightly, thus continually lubricating all parts needing it.

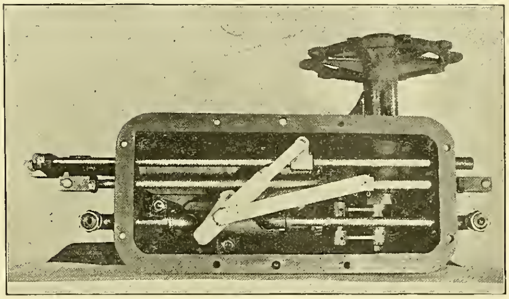


FIG. 2.

The operation of the brake is as follows: The pump in the box compresses air in the tank, maintaining 220 pounds pressure, and oil is used as a medium to transmit the stored energy of the compressed air from the tank to the brake-operating piston. Any movement of this piston will operate the brake lever, and so set the brakes of the car.

To operate this brake-piston, the pipe running from the three-way valve conveys the oil under pressure to move the piston, the flow of oil being regulated by the three-way valve, which may be set at will by the operator. A compensating lever mechanism, shown in Fig. 2, will close the fluid valve so that the large piston can be held at any position or part of its stroke; that is to say, the piston can be moved forward to put the brake on easy or hard, and held at any desired point. The same three-way valve similarly regulates the release and controls the throwing off of the brake shoes. As before stated, the oil is merely a medium of transmitting the power from the pressure tank to the operating brake-piston, and is carried by the force-pump back to the pressure tank after being used. In this case, the pump-shaft only has to make four or five revolutions to return to the pressure tank all the oil used in the operation of the brake.

The discharge of the brake is entirely noiseless and practically instantaneous. The use of oil for transmitting the power gives this brake several advantages namely: Ease of maintaining the pressure; absence of air leakage, and simplicity of operation. The average motorman will control the car better with this brake on his first trip, than he ever can with the hand-brake, because the least movement of his handle is instantly and proportionately responded to by the brake piston. In going down-grade he can relax the pressure of the brake shoes by very small increments, controlling his speed absolutely, while in making a start up-grade the same facility enables him to hold the car wheels at the critical point until the motor obtains control, when the easy release of the brake allows starting without a hitch or jerk. An important feature of this apparatus is that in an emergency the motorman can apply the full force instantly, with practically no physical exertion, and the brake remains set even if the motorman jumps. Emergency stops, it is said, have been made in six feet. The controlling rod is so placed that a collision would tend to open the valves and set the brakes.

Electrically Propelled Vehicles.

After a thorough investigation of the conditions to be met, and a careful consideration of the engineering points involved, as well as the probable demand for such vehicles, the C. E. Woods Company, Monadnock Building, Chicago, has designed a comprehensive line of electrically-propelled vehicles, or motocycles, with a view to thoroughly covering all the practical types of this class of apparatus.

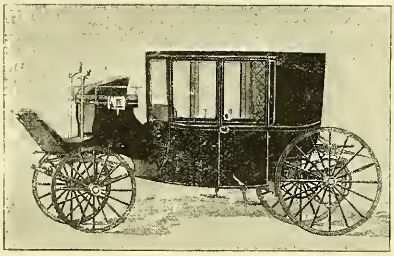


FIG. 1.

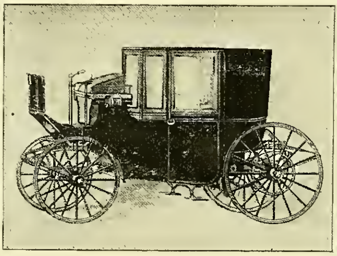


FIG. 2.

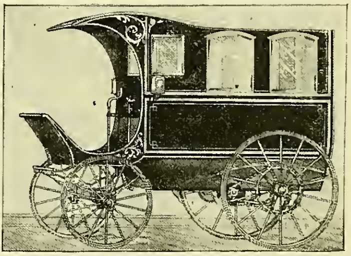


FIG. 3.

It was found by making several hundred inquiries that the average run of a cab, or public brougham, sometimes called a coupé, does not exceed 25 miles a day; hacks do not exceed an average of over 20 miles a day; time rentals for liveries do not exceed an average of over four hours, which would not average over 25 miles a run, and light delivery wagons rarely exceed 40 miles in a day. From a practical and commercial point of view, it would, therefore, hardly seem necessary to equip a vehicle for a continuous run of from 10 to 14 hours, or for a mileage capacity of 100 or more miles, unless such vehicles are intended to make long stretches across the country; ordinarily, the equipment would be a useless amount of weight to lug around for no advantage except in a special emergency. Pleasure wagons are never used more than three or four hours at a time; cabs, hacks, etc., making a run of 20 to 25 miles a day do not run on the average of over five or six miles per hour.

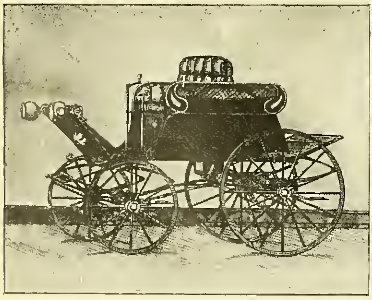


FIG. 4.

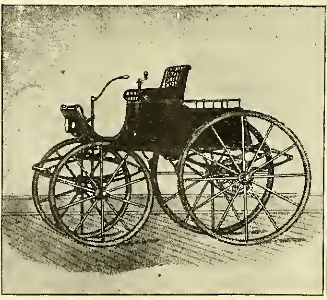


FIG. 5.

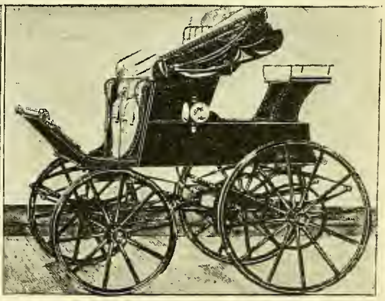


FIG. 6.

As to the relative advantages of gasoline and petroleum equipments, the former are but 25 per cent. lighter than good accumulator equipments, and do not take up much less room in the vehicle, while they possess the very undesirable qualities of disagreeable odors, unpleasant noise in operation, both mechanically and by their exhausts; the amount of heat which they must necessarily contain and carry with the vehicle; the fallibility of igniters, and lastly, presence in the vehicle of combustibles, which, no matter how well surrounded by safety guards, invariably prejudice the public mind. On the other hand, it is true, they present the following advantages: Somewhat lighter weight; a much greater mileage capacity with one charging; accessibility to fuel at most any point, and lesser cost in operation. The comparative difference is given as follows: Mileage capacity in petroleum and gas equipment, 100; mileage capacity in electric storage-battery equipment, 60; cost per hour for running gas and petroleum vehicles, about 25 per cent. less than for electric equipments. These figures apply to equipments of the same power in any type.

For an electrical equipment the weight is given as 800 pounds, as compared to 500 and 550 pounds for gas and petroleum equipment, but the former has the advantage of no noise, no heat, no presence of combustibles, far less mechanical complications, more instantaneous control and no reciprocating motion. The conclusion is drawn that, equipment for equipment, and mileage for mileage, everything would seem to be in favor of accumulators, except with respect to the access to fuel renewal; the establishment, however, of electric liveries and supply stations in large cities will overcome all these objections; this would naturally follow the adoption of electric road traction.

In design the electrical vehicle will not present the mechanical appearance which the others must necessarily have, but the departure from the shape and form of vehicles as we now know them will not be very radical, except, of course, that for the same amount of work the vehicle must necessarily be constructed somewhat heavier. The electric brougham and the electric landau, Figs. 1 and 2 respectively, have but little difference in their general contour as compared with the ordinary horse vehicle, yet the brougham is fitted with 24 cells of storage battery, and two .9-kw motors, or equivalent to a little over 2½ hp. The batteries are of a sufficient capacity to give a continuous normal effort of 2½ hp for five hours. The landau is equipped with 32 cells of battery and 1.2-kw motors, making a normal power of 2½ hp, and the delivery wagon, Fig. 3, has the same equipment as the landau. The road wagon, Fig. 4, and the trap shown in Fig. 5, are fitted with 20 cells of a smaller battery and one 1.5-kw motor, or about 2 hp each. The top carriage, Fig. 6, is fitted with the same equipment as the brougham.

A notable feature of the equipment of the top carriage is the arrangement of the controlling and steering devices, which are so designed as to operate the vehicle either from the footman's seat or the main seat of the vehicle. In the trap and wagons but one motor is used, which is on the rear axle, on which axle is also the strap brake; the other and heavier vehicles using two motors have one motor on either rear wheel. The design in proportioning the carriage is such that three fifths of the load is to rest on the driving wheels, in order to secure proper traction.

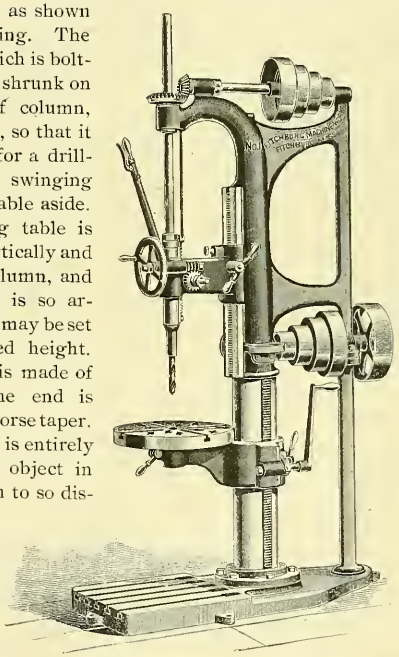
The application of two motors is desirable in public and street vehicles for large cities, as they will form their own mutual adjustments in the difference of speed between the two wheels in turning corners and other gyrations through the streets. The larger vehicles have an adjustment to five different speeds without the use of any rheostat whatever, and the controller is so arranged that it is impossible to put on the brake without cutting off the current from the motor.

The makers state that the entire construction of the electrical equipment has been designed with the same engineering care and study that would be given to a high-class electric railway equipment. The motor is of a special design, with special windings and design which will permit double the normal power to be used, under certain combinations, for starting torque, and for climbing grades. The design of controlling devices is such as to insure protection of the electrical equipment in ignorant hands, and also be positive in action and operation.

In the vehicles illustrated, the equipment has been designed to meet the specific conditions of each vehicle, with as artistic design as possible in the form of body. A vehicle equipped for a normal capacity of 2½ hp for five consecutive hours has in reality the ability to make a much longer run than that. If on a level road, the horizontal effort given by that power would produce a speed of 12 or 14 miles per hour; a lesser speed of, say, five or six miles, would give nearly a *pro rata* difference in length of time for operation, but not in mileage capacity. It is doubtful if public conveyances and business delivery wagons will be allowed a much greater speed than five or six miles per hour through the public streets, while often much of the way will be made at less than this.

The Fitchburg Drill Press.

The drill press shown in the accompanying illustration is built by the Fitchburg Machine Works, Fitchburg, Mass., to supply the demand for a strictly first-class machine for use in railway and other repair shops, capable of doing a large amount of work quickly and accurately. Great strength and rigidity is imparted to the column by the back post, as shown in the engraving. The base plate, which is bolted to a flange shrunk on the bottom of column, is planed true, so that it may be used for a drilling table by swinging the circular table aside. The revolving table is adjustable vertically and around the column, and the drill head is so arranged that it may be set at any desired height. The spindle is made of steel, and the end is bored to the Morse taper.



FITCHBURG DRILL PRESS

The design is entirely new, and the object in view has been to so distribute the metal as to give the best possible result, both as to strength and attractiveness. A friction clutch within the lower cone enables the operator to instantly start or stop the drill spindle. As there is no shipping of the belt only a 3-inch face pulley is necessary on the line shaft. Worm and worm-wheel feed is provided, with quick return, together with a ratchet lever-feed for hand drilling.

The head, table and arm are clamped by means of binders, therefore no wrenches are required for the drill. The dimensions are as follows: Diameter of revolving table, 18 inches; distance from centre of spindle to post, 9¼ inches; distance from revolving table to end of spindle, 37 inches; distance from drill or lower table to end of spindle, 49 inches; traverse of revolving table, 22 inches; traverse of spindle, 7 inches; diameter and face of driving pulleys on lower shaft, 12 inches x 3 inches.

FINANCIAL NOTES.

LARGE RENTAL.—The Metropolitan Street Railway Company of New York will pay a rental of $215,000 a year in gold, in addition to the taxes, for the Eighth Avenue Surface Line, recently leased. This is at the rate of 15 per cent. on the stock and 6 per cent. on the bonds of the latter company.

RECEIVER APPOINTED.—William L. Dayton, ex-Minister to The Hague, was on Tuesday appointed receiver of the Asbury Park & Belmar Street Railway Company by Judge Green, of the United District Court. The road runs from the Ocean Grove gates to Shark River, Belmar.

MERIDEN (CONN.) STREET RAILWAY ABSORBED.—The Consolidated Railway Company has acquired the whole of the capital stock of the Meriden Street Railway Company excepting 22 shares. The new officers are N. H. Heft, of Bridgeport, president, and W. L. Squire, of Meriden, secretary and treasurer.

TERMS OF BROOKLYN TRACTION LEASE.—The terms on which the Brooklyn Traction Company is to be leased to the Nassau Electric Railway Company of Brooklyn are reported to be as follows: The $6,000,000 common stock and the $3,000,000 preferred stock will be wiped out and a new issue of $4,500,000 is proposed. Preferred stock will be exchanged dollar for dollar, and will be guaranteed 3 per cent. the first year and 4 per cent. thereafter. Common stockholders will have the option of paying $750 on each 100 shares, and receiving Brooklyn, Bath Beach & West End five per cent. bonds, or to pay 2 per cent. cash assessment and receive one share of new stock for every four of the old, and be guaranteed 2 per cent. the first year and 4 per cent. thereafter.

TRACTION EARNINGS.—The Baltimore Traction Company's gross earnings for the first 22 days of November increased $10,100, and the Metropolitan Traction Company's gross earnings for the same period increased $94,650, or at the rate of $129,000 for the month. The Columbus Street Railway reports for the fourth week of November a comparative increase of $1527 in gross earnings; this in contrast with an increase of $387 for the third week. The North Shore Traction for the third week of November reports a comparative increase of $654 in gross earnings. For three weeks of November there was an increase of $25,120 in gross earnings of the New Orleans Traction. It will be noticeable that no mention is here made of operating expenses, nor of net returns; data on these heads are always interesting. The Lynn & Boston for the month of October makes quite a full showing of its operations, as follows: Gross receipts, $106,831; net receipts, $39,286. The net receipts for October of last year were $36,718.

LONG ISLAND TRACTION SALE ENJOINED.—The foreclosure sale of the stock of the Brooklyn Heights Railway Company, the Long Island Traction Company, the right, title and interest of the Brooklyn Heights Company in the 999 years' lease of the Brooklyn City Railway Company, and the stock of the Brooklyn, Queens County & Suburban Railway, which was ordered to take place at the Real Estate Exchange in this city on Thursday, Dec. 5, has been postponed. The plaintiff in the foreclosure proceedings, which were brought in Virginia, because the Long Island Traction Company was incorporated in that State, was the New York Guaranty & Indemnity Company, which holds collateral trust notes of the Long Island Traction Company for $2,000,000. These notes were taken up by the Indemnity Company, and bear interest at 6 per cent. The interest was due in August last, and there was a default in the payment. An order adjourning the sale was issued by Judge Nathan Goff, of the United States Circuit Court for the Eastern District of Virginia, on an application by counsel for Mrs. Emma J. O'Connor, a stockholder of the Brooklyn Heights Railway Company, who alleges that there has been mismanagement, and a reckless waste of money in the conduct of the roads concerned, and also asserts that the issuance of the notes was irregular. Mrs. O'Connor has applied for a rehearing of the decree of sale, and the case will be argued in the Virginia court on the 12th inst.

CHICAGO CITY RAILWAY RUMORS.—It was rumored in financial circles last week that troublous times are ahead in the directorate of the Chicago City Railway Company. The annual meeting of the company occurs Jan. 15 next, at which time it is hinted that the resignation of President George H. Wheeler may be accepted, and other radical and sweeping changes made in the active management of the company. The announcement made the other day that the capital stock of the company is to be increased by $2,000,000, and a large outlay made in electrical extensions was taken as an indication of harmony in the board. It is said, however, that a strong opposition to these and other details of management will probably be manifested when the latter come up for ratification by the stockholders. There has been some friction also in the matter of the present bond issue of the company, amounting to $4,619,500. President George H. Wheeler, when asked about the rumors of dissatisfaction and possible reorganization, said: "It is all news to me. There is no dissatisfaction that I am aware of, and I have not heard of any proposed changes of management." Samuel W. Allerton and William B. Walker, directors and large stockholders in the company, made similar responses to inquiries. Both said there was harmony in the board of directors, and that no charges of mismanagement had been brought to their notice. Up to Dec. 31, 1890, the capital stock of the company was $5,000,000. Jan. 2, 1891, it was increased to $6,000,000; July 13, 1891, to $7,000,000; January, 1893, to $9,000,000, and July 1, 1895, to $10,000,000. The standard dividend rate is 12 per cent., but in 1893 the stockholders received 24 per cent. The net earnings have shown a steady annual increase until last year, when they fell below the net earnings of 1892. The net earnings for the present year are said to show an increase over 1894, and the equipment of most of the horse-car lines with electricity has largely reduced operating expenses.

NEWS OF THE WEEK.

SKOWHEGAN, ME.—It is proposed to build an electric road from Skowhegan to Athens.

BURLINGTON, VT.—An electric railway between this place and Hinesburg is contemplated.

MEADVILLE, PA.—It is said that the Meadville Street Railway will be extended to Cambridge and Edinboro.

ALBANY, N. Y.—A company to build and operate an electric railway between Albany and Schoharie has been organized.

WATKINS, N. Y.—It is reported that the Watkins & Mantua Falls Electric Railway system will be extended to Horseheads.

PROVIDENCE, R. I.—The city authorities are urging the extension of the electric railway system on Park Avenue and North Main Street.

PHŒNIXVILLE, PA.—There is now a plan on foot to build a trolley road from Phœnixville to Pottstown, via Spring City and Royersford.

NASHVILLE, TENN.—Right of way has been granted to the Nashville Street Railway Company to lay additional tracks on West Line Street.

KNOXVILLE, TENN.—An ordinance has been passed granting a franchise to the Citizens' Railway Company to extend its line in four directions.

SACRAMENTO, CAL.—An ordinance has been passed authorizing the Central California Electric Company to extend its lines from Sacramento to Roseville.

PITTSBURG, PA.—The Pittsburg & Monongahela Traction Company has received its charter, and will build an electric railway about two miles in length.

MONTREAL, CAN.—The Park Island Electric Railway Company has been requested to establish a street railway connection between Cote St. Paul and this place.

CALDWELL, N. J.—The Borough Council has passed over the veto of Mayor Harrison an ordinance granting a franchise to the North Jersey Street Railway Company.

WATERBURY, CONN.—The directors of the Meriden, Waterbury & Connecticut River Railway Company are contemplating the substitution of electrical equipment on the road for their steam locomotives.

BALTIMORE, MD.—Ordinances have been presented by the Baltimore Traction Company and by the City & Suburban and the Central Railway Companies for franchises on the streets leading to Clifton Park.

GLOUCESTER, N. J.—The Gloucester City Railway Company, according to Henry McAllister, the company's consulting engineer, expects to build several miles of new track in the immediate future.

GORHAM, ME.—At a special meeting of the voters of the town a resolution was read disapproving of the action of the railway commissioners in denying the location for an electric road between Westbrook and Gorham.

CHICAGO, ILL.—It is reported that the 20 odd miles of railway which the Suburban Electric Company proposes to build through La Grange, Riverside and other suburban towns will be completed in the shortest possible time.

SYRACUSE, N. Y.—The directors of the Pleasant Beach Electrical Park Association held a short session recently, and a stock company was formed for the purpose of building an electrical road to the beach and Baldwinsville.

ORANGE, N. J.—An ordinance has been passed by the Common Council granting the Suburban Traction Company permission to extend its lines along Scotland Street to Tremont Avenue from the present terminus of the West Orange line.

HARRISBURG, PA.—The parties who recently purchased Penn's Cave, Centre County, are making arrangements for the construction of an electric railway from the Cave grounds to Centre Hall, and also propose to light the Cave by electricity.

SHEBOYGAN, WIS—The electric street railway line, 11 miles long which has been under construction all Summer, was successfully opened last week. The road is thoroughly equipped with the latest machinery, over $150,000 being expended in its construction.

PITTSBURG, PA.—The Braddock Electric Street Railway resumed traffic recently. It is a rival of the Second Avenue for business, is said to have been taken under the wing of the Duquesne Traction Company, and will extend its line to Wilmerding and Turtle Creek.

WEST NEW BRIGHTON, S. I., N. Y.—At a meeting of the Board of Village Trustees the executive committee recommended to the Board that they grant the application for right of way of the Staten Island Midland Railway Company, so far as the same refers to certain streets.

NEW HAVEN, CONN.—The Winchester Avenue Railway Company has retained counsel to appeal from the action of the court of Common Council requiring the company to pay $700 a year per mile for its track through Washington Street. It is understood that the case will be carried to the highest courts.

HARRISBURG, PA.—The Chester & State Line Railway Company has obtained a charter for the construction of a railway from the junction of Chester Creek and the Delaware River to the intersection of the Delaware River and the State line, a distance of 4½ miles. John E. Thompson, of St. Louis, is president of the new company.

BROOKLYN, N. Y.—The Atlantic Avenue Railway Company has asked the Brooklyn Aldermen for permission to extend its Bergen Street line from Rochester to Rockaway Avenue. A protest signed by nearly 1000 property owners on Monroe Street has been presented to the Aldermen against the proposed trolley line on First Street.

HARRISBURG, PA.—A petition has been filed with the Board of Selectmen by B. W. Russell and others for permission to establish street railway tracks on Lynnfield and Washington Streets to complete the route of a proposed railway connecting Peabody, Lynnfield and Wakefield, to be known as the Peabody, Lynnfield & Wakefield Railway.

SANTA BARBARA, CAL.—The Santa Barbara Consolidated Electric Company, which holds franchises for electric roads to Carpenteria, has acquired property on Alcott and Lillie Avenues, Summerland. A power-house will be erected sufficient for the needs of the line and for the local supply of light and power. Work has been begun on the foun-Clark and dations.

CHICAGO, ILL.—The first electric street car on South Clark Street made its initial trip on Monday. A gang of men finished stringing the overhead wire to the north side of the intersection of Washington and Clark Streets during Sunday night, while another gang of men was employed in putting in the electric car crossings at the intersection of Sixteenth Streets.

BATAVIA, N. Y.—The franchise that was granted to A. B. Wilgus, of New York, to construct and operate a street railway in Batavia expired Dec. 1, and he is anxious to have it renewed. He has stated that he will be able to go ahead and get the line in operation if given more time. A request for the extension of the franchise will be made at the next meeting of the Board of Aldermen.

PITTSBURG, PA.—The Carnegie & Pittsburg Electric Railway is busily engaged in extending its tracks across the Pan Handle line at the west end of the town of Carnegie. The work has been hanging fire for several months pending an injunction obtained by the steam railroad company. The electric line from this city to Carnegie is nearly nine miles long, and practically parallels the Pan Handle road.

POTTSTOWN, PA.—A charter has been granted to the Pottstown & West Chester Electric Railway Company. John P. Robinson, of Philadelphia; Arthur C. Ash, of Trappe; A. C. Clay, of Pottstown; Henry H. Robson, of Collegeville; Forrest D. Ash, of Spring City, and Joseph F. Ash, of Trappe, are the directors. The length of the road will be 22½ miles, and it will run from South Pottstown to West Chester.

WESTPORT, CONN.—The work of newly constructing and electrically equipping the Westport & Saugatuck Street Railway is about completed and cars will be running over the road on regular time in about a week. With the running of electric cars on this road will end the use of horse power for street-car purposes in this State, the Westport & Saugatuck being the last to equip electrically. The road has been extended about two miles and will be altogether about four miles long.

PHILADELPHIA, PA.—The transfer agreement between the Union Traction Company and the Hestonville, Mantua & Fairmount Passenger Railway Company expired at midnight, Nov. 30, and the officials of the two companies announce that it will not be renewed. By this agreement passengers over the Hestonville road were enabled to travel over any of the intersecting lines of either the People's, Electric or Philadelphia Companies, and *vice versa*, by purchasing eight-cent exchange tickets.

VANCOUVER, B. C.—It is reported that a large English syndicate has bought up the Vancouver Electric Tramway Company, the New Westminster & Vancouver Interurban Electric Tramway & Light Company and the New Westminster City Electric Tram Company. It is said that the syndicate will spend $500,000 in improvements and extensions, the purpose being to utilize the water power of the Seymour River to operate all the systems bought in. The syndicate has also bought the Victoria Electric Tramway.

ST. CATHERINES, ONT.—The Lincoln Radial Electric Railway Company has applied to the government for permission to construct and operate electric railways between this city and the villages of Jordan, Beansville and Grimsby, with branch lines to Compden and Southville, passing through the townships of Grantham, South Clinton and North Grimsby. The company also contemplates building lines to Port Dalhousie, Homer, Virgil and Niagara, branching to the villages of St. Davids and Queenstown.

BELMAR, N. J.—A map of the route of the new electric road, to run from Belmar to Point Pleasant, has been filed in the office of Secretary of State at Trenton. Among those interested are George Potts and Washington White. The road will start from the northern boundary at Belmar, and after belting that town will run through Como, Spring Lake, Willow Park, Seagirt, Manasquan and Briolle. At Manasquan a spur will be built to the railway. The new road will be known as the Asbury Park, Belmar, Spring Lake & Manasquan division of the Atlantic Highlands, Red Bank & Long Branch Electric Railway.

MILWAUKEE, WIS.—The Committee on Railways of the Common Council at an executive session held last Saturday voted to recommend for indefinite postponement the McGann Street Railway franchise ordinance. The McGann people tried to secure a franchise and build a line between Milwaukee and Cudahy. Afterward an attempt was made to secure a franchise through the city. Recently the committee decided to report an ordinance which gave the city the right to revoke the franchise at any time. As it was certain that the company would not accept an ordinance which placed them so completely in the hands of the Council, the committee changed front and decided to recommend the indefinite postponement of the whole matter.

PERSONAL NOTE.

MR. FRANCIS R. UPTON, for many years prominently identified with Edison and General Electric interests, has resigned his position as general manager of the incandescent lamp department of the General Electric Company, to accept a responsible position with the National Tube Works, McKeesport, Pa., manufacturers of iron pipe, poles, etc. Mr. Upton takes with him the warm esteem and kindest wishes of his former business associates, as well as those of his many friends throughout electrical circles.

TRADE NOTE.

THE WESTINGHOUSE MACHINE COMPANY, of Pittsburg, Pa., is distributing copies of a handsome little pamphlet containing points concerning its celebrated engines and their manufacture. Two views of the interior of the Works are given, which are interesting notwithstanding their small size. "Originality," says the pamphlet, "is a distinguishing characteristic of the Westinghouse engines, not only in their design, but in the methods employed in their manufacture." And an investigation of the subject will be pretty sure to convince the reader of the futility of attempting to controvert this statement. The care bestowed upon the engines prior to shipment is especially praiseworthy. Every engine, from a five-hp "Junior" to a 700-hp compound, is run in the testing room for several days continuously, under full load; it is then taken to pieces and every part carefully and rigidly inspected, to make sure of its being in proper condition. When everything is known to be in perfect condition the parts are re-assembled, permanent adjustments made, and the engine is jacketed, painted and shipped. It is to such conscientious practice as this that the enormous sales of these engines are largely due.

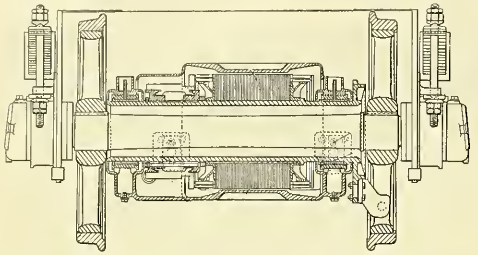
Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED NOV. 26, 1895.

550,273. CAR BRAKE; John C. Jensen, Chicago, Ill. Filed Feb. 21, 1895. In a brake for the purpose described, the combination with a stationary rail of a pair of pivoted brake shoes or jaws adapted to swing together upon said rail, a toggle lever having one end pivotally connected to each of said brake shoes or jaws, a rising and falling crosshead, links connecting said crosshead with the middle joint of each of said toggle levers, a lever and a link connecting said lever with said crosshead for raising and lowering the latter.

550,319. ELECTRIC TRAMWAY WITH UNDERGROUND DISTRIBUTION OF CURRENT; Alfred Diatto, Turin, Italy. Filed Sept. 18, 1894. The combination with a conduit inclosing the underground conductor or conductors, a series of contact plates or pieces in the top of said conduit and insulated from the ground and provided with projections on their inner surfaces, and circuit-closers comprising a bar of soft iron and a cylinder containing mercury, said circuit-closers communicating with the underground conductor, of electrical appliances supported on a car or carriage and including a magnetized bar which is adapted to glide over aforesaid contact plates or pieces, and thus connect said plates or pieces with the underground conductor through magnetic induction from the carriage, the aforesaid circuit-closers returning to the position of repose by their own weight when the magnetized bar completely uncovers the contact plates.

550,344. ELECTRO-LOCOMOTIVE; Jean J. Heilmann, Paris, France. Filed Feb. 13, 1895. In an electro-locomotive, the combination with the axle and driving wheels, of a frame spring-supported on said axle, a motor mounted on said frame, having a hollow armature shaft encircling the axle and of an internal diameter sufficient to permit relative displacement of the axle and shaft, pairs of oppositely disposed spring buffers carried by one of said wheels within the planes of the faces of said wheel, and radial arms secured to one end of the armature shaft, each entering loosely between two buffers composing a pair. (See illustration.)

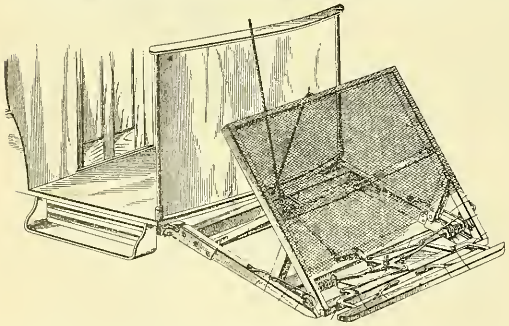


NO 550,344.—ELECTRIC LOCOMOTIVE

550,387. CAR FENDER; William F. Duncker, Steelton, Pa. Filed Aug. 14, 1895. In a car fender, the combination with a car of an upper section or shield hinged at a point intermediate of its end to the car and having its upper portion arranged to extend in advance of the bumper of the car, a lower section hinged to the bottom of the upper section or shield and projecting outward therefrom, links loosely connected with the car and pivotally connected with the lower section in rear of the upper section or shield, a bell crank lever fulcrumed at its angle beneath the car, an operating bar or lever extending through the bottom of the car and connected with the front arm of the bell-crank lever, and a link connected with the rear arm of the bell-crank lever and with the lower section of the fender.

550,393. ELECTRIC CAR TRUCK; Louis J. Hirt, Somerville, Mass. Filed March 5, 1894. In a four-wheel electric car truck, a truck frame comprising straight side bars extended beyond the car axles of the truck, and independent pocketed spring supports extended in line with and beyond the ends of the said side bars and detachably secured thereto, the said spring supports comprising a bottom plate, upright walls forming the spring pocket, and a rearwardly extended arm fastened to the said side bars, the bottom plate being below the upper surface of the said side bars.

550,419. CAR BRAKE; John A. McGrath, New Orleans, La. Filed April 19, 1895. In a car brake, the combination with a central transverse truck bolster, rigidly mounted on the truck, of brake shoes and straps, pivotally connected to said beam at one end and extending partly around the wheels and flanges, toggle levers pivotally connected to beams upon the movable ends of said straps and to the car trucks, a double brake lever fulcrumed upon one of the brake beams and connected to the other brake beam by means of a chain.



NO. 550,448.—CAR FENDER.

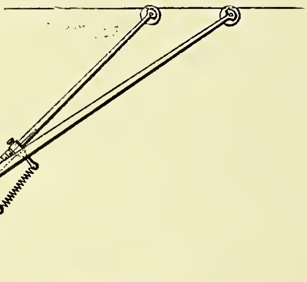
550,421. LIFE-GUARD FOR STREET CARS; Richard Pollard, Syracuse, N. Y. Filed March 18,1895. The combination, with a street car, of longitudinal moving racks on opposite sides of the car, springs forcing said racks forward, manually controlled detents retaining the racks in their retracted position, dogs locking the racks in their forward position, a crossbar attached to the front ends of the racks, a plurality of chains extending from said crossbar to a fixed support on the car above the racks, an intermediate crossbar attached to said chains, a fender apron over the chains and attached at opposite ends to the aforesaid crossbar and chain support links suspended from the intermediate crossbar and loosely embracing the racks and shoes on the latter crossbar and sliding on the racks.

550,437. ELECTRIC RAILWAY; David Brooks, Jr., Philadelphia, Pa. Filed Feb. 28, 1894. In an electric railway, insulators and suitable supports therefor, hoods sustained on said insulators, strips of wood supported by said hoods, a sectional trough on said strip, an electric conductor interposed between said strip and hoods, and pieces of fusible material connecting said section and conductor.

550,448. CAR FENDER; George W. Greer, Gap, Pa., assignor of three fourths to Christian L. Kaufmann, same place. Filed April 8, 1895. A fender consisting of a base frame removably secured to the car, a fender frame secured to the base frame by link and bolt connections, guard wires arranged on the base frame, spring-pressed bolts on the fender frame engaging the guard wires, a central lever having connection with a second lever with forwardly extending arms and a spring-pressed trip for actuating the same. (See Illustration.)

550,458. TROLLEY; Eugene L. Richter, Philadelphia, Pa. Filed March 27, 1895. A trolley pole, a sleeve secured thereto, a pair of collars mounted on said sleeve, the lower one of said collars having journals extending therefrom, side pieces mounted on said journals, laterally extending arms attached to said pieces, springs extending from said arms to a suitable portion of said upper collar, a wheel journaled in the upper portion of said side pieces, and a stop or brace attached to the latter, said upper collar being held in position by a set screw passing therethrough and engaging a groove in said sleeve. (See Illustration.)

550,465. ELECTRIC RAILWAY; George Westinghouse, Jr., Pittsburg, Pa. Filed June 13, 1890. The combination of an electric railway car, a pivoted arm mounted on the car and swinging laterally, a collector supported by the pivoted arm, whereby electrical connection may be made with an overhead conductor; springs acting on the opposite sides of the pivoted arm, one of which is normally stronger than the other, and a tension device connected with the second spring so that its tension may be increased at will to overcome the strength of the first spring.



NO. 450,458 —TROLLEY.

550,467. ELECTRIC AND FLUID LOCOMOTOR; George Westinghouse, Jr., Pittsburg, Pa. Filed Feb. 5, 1892. In a variable speed gear, the combination, with a means of supplying fluid pressure, of a hydraulic motor having extensory paddles, and a device for varying the surface of said paddles exposed to the driving liquid.

550,481. CONTROLLING APPARATUS FOR ELECTROMOTORS. Jean B. G. A. Canet and Andre Hillairet, Paris, France. Filed August, 1894. Patented in France, Nov. 28, 1893. Apparatus for starting, stopping and controlling electromotors, comprising a stop switch, a reversing switch adapted to change the direction of current through an electromotor, an electromagnetic clutch having its circuit controlled by said stop switch, electric stops adapted to be operated by the body or machine the motion of which is to be controlled and capable of breaking the circuit of said clutch, means for operating said switches and one part of said clutch, a rheostat adapted to be placed in circuit with said motor by reversing switch and provided with a commutator, a brush-carrier connected with the rotary part of said clutch and carrying brushes arranged to travel in contact with said commutator, and means for returning the brush to its normal position when the circuit of said clutch is broken.

550,502. FARE-BOX; Leroy C. Godwin, Portsmouth, Va., assignor of two thirds to Arthur J. Phillips and Leonard C. W. Page, same place. Filed Feb. 13, 1895. A fare-box, comprising a box having a rearwardly inclined partition in its throat and provided at its lower end at one side with an apertured lug, a plate pivoted in the throat adjacent to the lower end of the partition and forming with the rear wall of the throat a passage for a coin, a second plate pivoted in the rear of the first plate and having its lower end curved and extending forwardly beneath the said first plate, a dumping platform in the bottom of the box, a receptacle having an interlocking engagement with the box at one side and provided with an apertured lug registering with the lug of the box, and means for securing said lugs together.

Electric Railway Gazette.

Vol. XIII. NEW YORK, DECEMBER 14, 1895. No. 24.

The Sea Shore Electric Railway.

The Sea Shore Electric Railway of New Jersey is one of the few electric roads dependent for its traffic almost entirely upon the Summer residents of the resorts along its line. The system comprises about 22 miles of road, mostly double track, and extends through some of the most famous Summer resorts along the New Jersey coast.

The road starts at Asbury Park and extends north to Loch Harbor, thence through Deal Beach and Elberon, and from there it turns west to Long Branch, the present terminus of the line. Direct and rapid communication between the several towns is afforded, and the fact that the road is a great convenience and is appreciated, is thoroughly demonstrated by the immense traffic during the Summer season.

The road is well laid out and as the country through which it passes is open and level, there are practically no grades and few curves. The roadbed throughout is of a most substantial character. The portions of the track occupying paved streets in the various towns are laid with girder rails weighing from 56 to 70 pounds to the yard, and substantial T rails are employed on the greater part of the track between towns. The rails are laid on oak ties laid about two feet apart, centre to centre. The return current is amply provided for by heavy copper rail-bonds.

Wood side poles are employed on the greater part of the system. The overhead construction is carried out in a substantial manner and the material employed is of the best.

The power plant is located at Asbury Park; the building is of brick, one story in height; and being located alongside of the tracks of the Central Railway of New Jersey, excellent facilities for the receipt of coal are provided. The power equipment at first consisted of one double engine of 500 horse-power, and three General Electric multipolar generators. This engine is of the Hamilton-Corliss type with cylinders measuring 21″ x 42″. There are two fly-wheels, each 18 feet in diameter and three feet across the face.

The generators are shown at the left in Fig. 1. They are belted directly to the engines by twenty-four-inch belts, two generators being driven tandem from one fly-wheel, and one from the other. The equipment has recently been increased by the installation of a 750-hp direct-connected unit, shown in Fig. 2. The engine (see Fig. 3) is of the Reynolds-Corliss cross-compound type, with extra heavy bed plates, and is of the latest model built by the E. P. Allis Company for heavy railway work. The generator is of the Westinghouse multipolar type with its armature mounted directly on the engine shaft. The

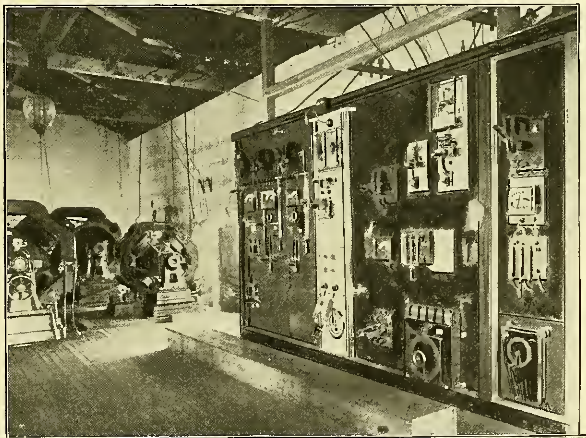


FIG. 1.—VIEW OF DYNAMO ROOM.

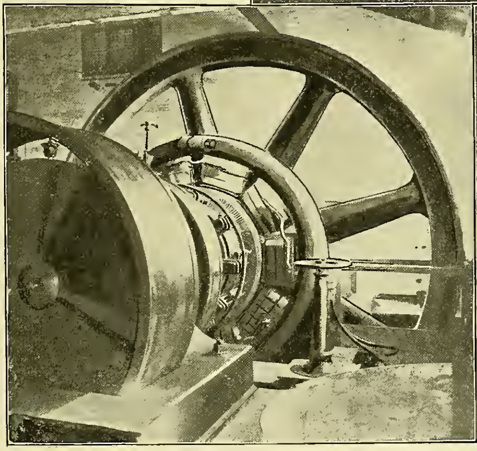


FIG. 2.—DIRECT-CONNECTED SET.

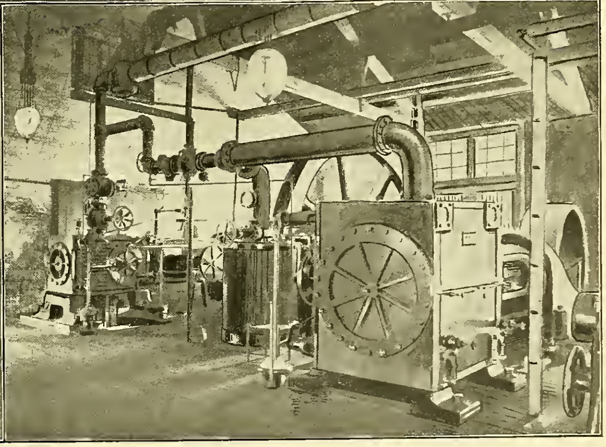


FIG 3.—REAR VIEW OF THE ENGINE.

switchboard shown in Fig. 1, is conveniently located at about the centre of the north side of the engine room, and is fully equipped with the usual switches, indicating instruments, circuit-breakers, and lighting arresters of Weston and Westinghouse make.

The boiler room is located in the west end of the building. The floor of the room is level with the ground, and about 8 feet below that of the engine room. The boiler equipment consists of one battery of two Babcock & Wilcox water-tube boilers, of 350 horse-power each. There are also three horizontal tubular boilers, which at present are employed as water tanks, but which are maintained in good condition, so that in an emergency they could be used for supplying steam.

The arrangement of the steam piping system is excellent, and precautions have been taken to reduce the liability to a complete shut-down to a minimum.

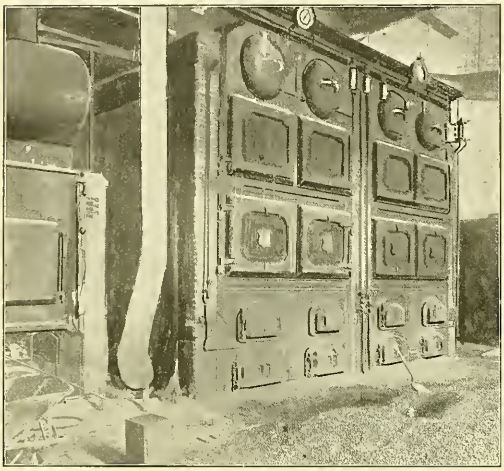


FIG. 4.—BOILER FRONTS.

The rolling stock of the system consists of about 60 cars, built by the St. Louis Car Company, which are of excellent construction and tastefully furnished. The trucks in use are of the St. Louis, Brill and Peckham types. The car barn is located near the power station, and has ample storage capacity for all the cars, and also contains the company's offices and the repair shop.

As the road extends through a sandy region some trouble and annoyance is caused by sand being blown on the tracks. To overcome this difficulty, Mr. A. S. Hickley, general manager and electrician of the road, has designed and patented an ingenious track-cleaning device. The arrangement is very simple and consists of a couple of circular brooms supported by a bracket which is bolted to the end of the car truck. The brooms rest upon the rails and are caused to revolve by this contact as the car moves along. The brooms are held obliquely to the track, so that the effect of their rotation is to brush the sand away from the tracks and clean the rails.

Substantial Railway Taxes.

Probably the largest sum paid to the City of Brooklyn by any one corporation for taxes is the $195,000 which the Brooklyn Heights Railway Company will pay this year. And yet the municipal authorities complain!

The Trolley Opinion.

On Saturday, Dec. 7, Judge Townsend, of the United States Circuit Court for the District of Connecticut, handed down an opinion sustaining the fundamental patent of Van Depoele on the trolley, and declaring void a subsidiary patent applying to the rotating support upon which the trolley arm swings. In the opinion the two patents are referred to as the first and second patents, respectively, which designations will be followed here.

The opinion states that the defenses to the first patent are that the alleged invention was made by an employee of the Van Depoele Company; lack of patentable novelty, in view of the prior state of the art, and that the same invention had been previously disclosed by and patented to Van Depoele. The Court then digresses to condemn the padding of the record, that of the complainant covering 3142 pages, and the defendant occupying 2237 pages. The inordinate mass of testimony taken, and the confusing number of extracts introduced, are referred to as a rapidly growing abuse, and if admonition will not answer it is declared that the next step will be the punishment of the offending party by the imposition of costs.

The invention of the first invention is defined as relating to improvements in the devices whereby contact is maintained between the trolley car and the overhead wire conductor, and embracing the long swinging, pivoted, hinged, and upwardly spring-pressed arm extending from a support on the top of the car, and equipped with an underrunning contact device. The claims are quoted, but it is stated that it will not be necessary to consider them together as it is agreed that, while some are broader than others, they all cover substantially the same combination, so far as the issues of the suit are concerned. The combination of claims is declared to be of great utility in the art of electric traction, to have superseded every other known apparatus, and, furthermore, that the experts for defendant admit that they do not know any one other than Van Depoele prior to September, 1885,

> had proposed to equip the car of an electrically propelled road with a contact device mounted on the end of a long pole upwardly pressed by means of a spring, and to hinge the pole to the car and make it turn on a pivot; nor that any one, prior to March 12, 1887, the date of the application for the first patent, had described in an electric railway the combinations specified in the infringed claims.
>
> The earlier electric railways, when equipped with wire conductors above the car, maintained contact therewith by means of "over-running" trolleys connected by a cord or wire with the car, and towed along above the surface of the conductor. These devices were impracticable for general use, because of uncertainty of connection, lack of adaptability to various forms of switches, varying tension, liability to derailment and other reasons.

The advantageous features of the construction which give the present system its value are declared to be

> (a) the location of the supply conductor above the track and line of travel of the car and contact with its under side; (b) the arrangement of the contact device on a trailing arm; (c) the maintenance of a constant upward pressure by means of a tension device operating upon a hinged arm. By the use of this system numerous difficulties are overcome and corresponding advantages obtained.

Referring to the claims of the defendant in support of its denial of patentable novelty in view of the prior state of the art, the opinion says it shown generally

> that electric railways, suspended conductors and contact devices were old, and that the utility of such devices for conducting the current from such conductors to the instrument on the car was well known and variously applied.
>
> These systems, so far as the present consideration is concerned, were chiefly used either for electrically lighting a car, or for signaling to or from it. But defendant claims that, as in each case the object to be

accomplished was to get a current from a conductor to a motor in the car, the difference in the ultimate result is immaterial.

Counsel for complainant, on the other hand, claims, relying upon a long-settled rule of law, that said devices, as a matter of law, do not anticipate the patented device, because they relate to a remotely allied art, and did not suggest in their construction the particular problems which were presented by the conditions of trolley systems and solved only by the inventions of the patent suit. He further relies upon the fact that material alterations required to adopt these devices to said new use, and that the effect of said transfer has been to supersede other methods of accomplishing said results.

In the determination of this question the Court considers it necessary to examine some of these earlier patents.

For the determination of this question it will be necessary to examine some of these earlier patents. Several of them refer generally to the use of a contact device for conducting a current from a main conductor located above, at the side, or below, the line of travel of the car, to the motor, or signaling, or illuminating instrument on the car. For securing contact, some use brushes, others, trolleys dragged by the car; others show a grooved sheel or a wheel running between two conductors. It is not necessary to determine the effect to these patents upon the prior state of the art further than as showing that under the comprehensive art of distribution of electricity. Devices for taking electricity from a stationary conductor and conducting it to a translating device, were old, and that the utility of a grooved wheel, as distinguished from one not grooved, or a rigid arm as distinguished from a flexible cable, or spring pressure, as distinguished ished from gravity, of an overhead conductor, as distinguished conductors otherwise located, of an underneath contact, as distinguished from an overrunning contact and of a wheel or roller, as distinguished from a brush, were all well known, the principle on which they operated respectively, were well ascertained and the relative advantages and disadvantages of each well understood. The earlier patents are also suggestive of the fact that various devices were used according to the different requirements of various situations. It is not to be overlooked in this connection, however, that these devices referred to were without exception mere paper machines, which do not appear to have been capable of successful practical operation.

The proximate object or purpose to be accomplished by these inventions was the conveyance of a current from the conductor to a translating device on a moving vehicle. The question to be determined by comparison of these inventions with that of the patent in suit is whether, in their adaption to the purposes of electrical propulsion, some material change in the manner of application, or some substantially distinct result was accomplished. This brings us to a consideration of the changes which the patentee is alleged to have made in order to adapt these old inventions to the art of electrical propulsion. Each of the elements in the combination of the hinged and pivoted trailing arm and the upwardly-pressed contact device had been variously described in the earlier patents, and various devices had been used as equivalents for each other.

Certain patents are then considered in detail. In the Fitzgerald patent (June 29, 1869), the Court considers the inventor contemplated to use adjustable spring-pressed contact arms, so arranged as either to come in contact at fixed intervals with wires stretched across and above the track, or to maintain continuous connection by means of friction rollers with wires stretched alongside the track, and it is decided that the patent in suit is not thereby invalidated for two reasons.

First, because it is a mere paper patent, and the removal of the objections to its practical operation, and its adaption to the new purpose required something more than a mere mechanical skill. Second, because such vague, general and incomplete description is sufficient to enable a person skilled in the art to perceive its adaptability to the practical apparatus of the patent in suit and to construct the same.

The patent granted August 5, 1893, to J. C. Smith is defined as covering a

telegraphic apparatus on moving trains, and shows a swinging arm attached to the side of the car, having the branches fitted with brushes and rollers to make contact with these telegraphic wires strung near the side of the track and paralleled thereto near the level of the wheels of the car. There is a suggestion in the drawings of springs in each side of said fingers, giving a capacity for horizontal variations. If this device should be transferred to the top of a car, it would be so adapted as to maintain contact with an overhead wire and might, by a modification of the springs suggested but not described, be so arranged as to give an upward pressure and to follow vertical sinuosities of the overhead wires. A provision in the patent for the contraction or expansion of the arms further shows a capacity for vertical movement which might be utilized on the top of the car for a horizontal movement,

The Court, however, does not find in this patent, even with the modifications and adaptions named,

any such capacity for universal movement as would be required for the exigencies of electric railway switches and curves, nor when said arm is locked in an operative position, is there any provision for continuous upward pressure. Nor do I find in either the Fitzgerald or Smith patent any suggestion of means to overcome the problem of continuous connection at such great and varying overhead distances from the car as are encountered in the operation of the trolley system. The importance of this element will appear later.

Brunis patent (No. 189,999), it is stated covers an arm which swings only in a vertical plane, and the Wesson patent (No. 16,665) is pronounced not to suggest the patent in suit or meet the exigencies it met. Referring to the contact devices connected by third rails laid between the tracks, the Court considers it is not necessary to consider these in the art of electric car propulsion, as their capacity for vertical and horizontal movement was very limited. Earlier forms of overrunning towed trolleys are dismissed as impracticable, having been discarded.

But, as is forcibly argued by counsel for complainant, the fact that numerous skilled inventors, when first confronted by the problem of overhead contact, did not adopt, adapt and develop the electric railway signal art, already considered, but started out on the new and independent lines of the overrunning trolley, is most significant upon the question of invention in the patent suit. That they, working with a single object in view, rejected said existing allied or analogous art as impracticable, and invented improvements upon other lines, which have since been discarded for the improvements afterward made upon the existing art, is presumptive evidence that invention was required in the selection from and adaptation of the existing art.

Sherman Patent (302,596) showing a car suspended from elevated rails, and contact wheels rigidly mounted on short posts so as to maintain contact with a conductor loosely suspended above the car is declared to have none of the essential elements of the trolley arm, and the device is inferior, is pronounced inferior to the earlier wheel-contact device of Van Depoele, hereafter referred to. As to the Daft patent of Oct. 8, 1889, (No. 412,605) this is stated to be for a device of substantially the same construction as that of the patent in suit, except that it does not appear that it had any capacity for swinging laterally.

The application for this patent was filed June 11, 1888. The apparatus described therein was put in practical operation in June, 1886. Originally and prior to Van Depoele's invention, Daft had constructed a somewhat similar device, consisting of a trailing arm pressing downward on an underneath third rail conductor, and which it is claimed had capacity for both vertical and lateral movement. Defendant urges, therefore, that it was only necessary to turn this device over in order to obtain the patented invention, the earlier Daft device is an anticipation. There are several answers to this claim. When Daft did turn it over and patent it, he did not claim or show capacity for lateral movement of the arm, and therefore did not disclose a device capable of use for switches and curves. Again, when he undertook afterward to construct other roads, he abandoned this construction and went back to the overrunning towed trolley. Furthermore, in his Baltimore railway, which it is claimed anticipated Van Depoele, he admits that he was obliged to discard the contact wheel because it "was constantly jumping from the conductor; and, as it seemed impossible to mount it with sufficient resilience to obviate this difficulty," he substituted a wide, laminated brush, "which could see-saw at will across the conductor without breaking the circuit." Inasmuch as in providing for capacity for universal movement, which is the vital feature of the adaptability of the Van Depoele invention, he failed, as all others had done, I do not think the device of 1885, even if it had anticipated Van Depoele, is material, except upon the question of the primary character of the invention. These suggestions generally apply also to patent No. 263,132, granted Aug. 22, 1882, to Thomas A. Edison. The defense that one Sprague anticipated Van Depoele, does not require any consideration.

Certain patents introduced by defendant, showing a staging erected on top of the car, in order to bring the contact device close to the elevated conductor, are stated to strikingly illustrate one of the problems solved by the Van Depoele invention:

They show that when the problem was presented of furnishing a device capable of maintaining contact at great and varying distances above the car, other inventors solved it in the obvious way of providing an elevated framework or stage, on which they mounted the contact device. That such structures would be impracticable, by reason of their weight and rigidity, is manifest from inspection.

The Court then takes up the point as to whether Van Depoele was the original inventor of the patent in suit, and after discussing the evidence to the contrary of one Verstraete, made after the death of the former, and after nine years of silence, concludes that the burden of proof on the defendant to overcome the oath of the inventor, and this he has failed to do. The abilities of Van Depoele as an inventor are discussed at length, and an earlier trolley patent referred to, which consisted of a grooved roller so mounted on a spring on the roof of the car as to have a limited range of vertical and lateral motion. The history of the patent in suit is traced from this and the causes which led to its final form related.

The new problem presented was how to make practicable the electrical propulsion of an electrical railway by a continuous contact under all the conditions presented by crowded street, sharp curves, complicated switches, rough roads, reversed lines of travel and the necessity of a continuous upward pressure of from 8 to 15 pounds. The solution was accomplished by a long, rigid arm upwardly pressed, and capable of universal movement. "This arm," says the inventor, "possesses substantial, practicable advantages over any other means yet proposed for establishing moving contact between a vehicle and a stationary supply conductor, in that by use of a hinged flexible arm, much greater freedom of movement is compatible with the maintenance of a positive mechanical connection and electrical contact between the vehicle and supply conductors." Prior inventions in the same art had shown a similar contact with a rail under the car, but they failed to indicate or claim the element of spring pressure or capacity for lateral motion. Prior inventions in an allied art had shown by paper patents the principle of continuous or interrupted contact with such limited provisions for lateral and vertical motion as to be impracticable. Prior inventions in a remote art had shown in tethers for animals and in office chairs, spring pressure and universal movement. But the inventors in the art of electrical propulsion, signals or telegraphs had failed to provide for an operative contact device at the distance from the car required for the operation of the underrunning trolley road except by unwieldy and impracticable structures on the roof of the car. They had failed to adequately provide for considerable variations from practically straight lines of travel. In their later attempts to do so they had constructed or adapted contrivances which departed from the earlier devices now claimed to show lack of patentable novelty, and thereby furnish strong proof that the changes made by Van Depoele were not obvious ones. Defendant's expert is forced to admit that the advantages of an underrunning trolley were not obvious, and that the earlier constructors must have been in doubt as to the efficiency of such a system, and that the prior underrunning overhead devices would have led a person away rather than toward an upwardly pressed hinged conductor. In these circumstances the new use of old principles does not fall within the rule of a double use. The old use was not intended for nor adapted to the conditions of the new use; it produced in part only the results of the new use.

When Van Depoele discarded the elevated wheel and springs of his earlier patent and broke away from his own towed trolley and those of Siemens, Finney, Henty and others, and reversed the underrunning trolley of Daft and Edison, and adapted lateral motion thereto, and went to the overlooked art of the animal tether, or the limited and impracticable art of railway signals, and selecting and combining certain elements of those various contrivances, modified and adapted them to a new purpose, and thereby disclosed to the public a practically operative means such as the whole world of electrical railway inventors had theretofore sought in vain, and which has gone into universal use throughout the country, he made an invention within all the rules applicable to this question. I have been unable, therefore, to adopt the view of counsel for the defendant, that the art of conducting electricity from a conductor to a translating device on a moving vehicle was sufficient to enable a skilled mechanic to construct the device of said first patent. This well-known art had been already applied in the best forms which Van Depoele and others could devise before he made his invention. But when the new problems were presented it was shown that these devices and the underrunning rails and the overhead towed trolleys were all impracticable, and it then became necessary to abandon the old forms and to so construct and combine the earlier devices as to furnish new possibilities of operation and to produce new, non-analogous and unexpected results. The character and extent of these modifications may be further illustrated by a review of the chief advantages resulting therefrom.

The Van Depoele invention provided for the collection of the current from a conductor suspended so high above the ground as to be out of the way of travel across the road. While bridging this distance, it permitted a firm and uniform electrical connection with said conductor. It could be elevated to a great height without the use of a permanent high support on top of the car, and could be depressed to a level with the car. By its universal movement it was capable not only of following the ordinary lateral variations in the overhead conductor, but it would automatically maintain contact at sharp curves and at points where branch switches were used. In this latter respect it is far superior to every other form of device. The substitution of the long arm for other contact devices mounted upon high supports, obviated the necessity of permanently and accurately fixing the overhead conductor in position with relation to the track. The upwardly pressed underrunning wheel permits the automatic transfer of the contact device from one branch to another—a result which was impossible when contact was at the side and impracticable with an overrunning wheel.

The upwardly pressed device further dispenses with the strain upon the conductor of the former overrunning devices, and the two being independent of each other, the derailment of one does not damage the other, as was frequently the case with former devices. Finally, a further advantage of the Van Depoele device, shown by diagrams in the brief of counsel for complainant, consists in the capacity of the projecting or trailing swinging arm, to follow the necessarily curved line of the conducting wire at straight corners, while the car body is necessarily turning at an angle.

It is further significant upon the question of invention that prior to Van Depoele's application, in 1887, only 11 patents altogether had been granted for underrunning trolleys, while immediately thereafter the number of such applications was greatly increased, the total number in 1890 reaching 155.

The Court next takes up the claim of counsel for defendant that the invention embraced in the patent in suit was previously disclosed in prior patents to Van Depoele and patented by him, and that even "if the broadest form of the invention was not patented therein, nevertheless that the form claimed in the patent in suit was so inseparably involved in the patenting of the invention in the forms described and claimed in former patents, that the right to patent was exhausted upon the issue of the prior patents and the broad form was waived and became abandoned to the public." In support of this contention, Van Depoele Patent No. 424,695, dated April 1, 1890, for "suspended switches and traveling contact for electric railways," is chiefly relied upon.

The special point, which is claimed to be the same as in the patent in suit, is a weighted spring, which is said to exercise a centralizing tendence on the trolley arm. The Court considers that the spring in the earlier patent is not a tension spring, except in so far as such tension may incidentally assist in imparting a centralizing tendency to the arm.

The original application, filed March 12, 1887, claimed a spring and tension device, so arranged as to impart upward pressure. The improved device showed a spring and weight so arranged as to permit lateral motion to the arm, and to "constantly tend to restore the arm to its normal central position, and to assist it to partake of the lateral movement of the car," to give it a greater range of action, and to make it more convenient in operation. This patent, for this specific combination, adapted and claimed only for this specific purpose, applied for Oct. 22, 1888, after the original application had been allowed, but before the patent thereon was granted, was earlier in the date of issue. The original application was delayed by interference proceedings in the Patent Office. Whatever may be the rule as to cases where the application for the generic patent was filed subsequent to the application for the specific patent, I do not think the patentee should be deprived of his broad patent where the application for such patent was made first, and was delayed in the Patent Office through no fault of the inventor. Such a ruling would be a reproach to the law.

The opinion considers at great length the argument of counsel for defendant, based upon the decision in the *Miller vs. Eagle Manufacturing Co.* case, and the following conclusion arrived at :

The decision in *Miller vs. Eagle Manufacturing Company* merely affirmed the well-settled law that two patents for the same invention could not issue to the same patentee. There was nothing involved therein which affects the claims in suit herein. If any departure from the settled rule of construction is justifiable in any case, it should not be allowed for the purpose of destroying a meritorious invention embodying a construction which first made practicable the operation of the trolley railway under all conditions, and which is now employed on more than 500 electric railways in this country, representing an invested capital of about $500,000,000.

The second patent is then taken up, each claim of which is stated to cover the same construction—a rotating support for the post upon which the trolley contact arm swings. The various arguments of counsel for complainant are examined, and it is concluded that the same device had been used in other arts and that it did not require any peculiar inventive genius to perceive the relation between cause and effect and to grasp the idea that the device might be adapted to a new art. As to the argument that if there was no invention in the device Siemens, Edison and others would not have missed large fortunes by overlooking it, it is replied that:

> Until Van Depoele had disclosed the overhead underrunning spring-pressed, laterally swinging contact arm, there was no problem presented of reversibility of a rotating spring device or of unrestricted lateral motion. The reason for the universal adoption of the device of this second patent follows as a corrollary from the foregoing conclusions. Its adoption results not from its patentable novelty, but from its practicable utility in connection with the main invention. The doctrine that utility, in the absence of patentable novelty is immaterial, is especially applicable where the sole foundation for the claim of utility lies in the mere mechanical adaptability of a well-known device to a novel invention protected by a valid patent.

The following is the text of the decision of the Court:

> Let a decree be entered for an injunction and an accounting as to the claims in patent No. 495,443, and dismissing the bill as to patent No. 495,383.
>
> Let costs be taxed in favor of each party, as each succeeds as to one patent, but let judgment be entered only for the excess of the costs of one party over the other.

The Long Island Electric Railway.

The municipal legal obstacles having been removed, it is announced that work is to be resumed this month on the Long Island Electric Railway. The contracts have been given out anew and the iron has been ordered from Pittsburg. The road is to be completed to Far Rockaway by June next. Arrangements were made this week, it is said, whereby a connection with the Flynn system has been assured the new road and by the new Bergen Street line connecting with the Atlantic Avenue lines, thus enabling passengers to form direct connection with the Brooklyn Bridge and all the ferries. Connection will also be made with the Kings County Elevated road by means of an elevator or an incline. It is expected that express trains will make the trip from Far Rockaway to the Brooklyn Bridge in about an hour and a quarter, and that through tickets will be sold at all the stations on the Kings County Elevated road.

The new road will be 14 miles long, and will extend from the terminus of the Kings County Elevated road over Liberty Avenue, to Jamaica; thence through South Street of that village and over the line of the Jamaica and Rockaway turnpike nine miles to Far Rockaway and Inwood. Two miles of road through South Street, Jamaica, and beyond were built last Summer, when operations were brought to a stop by legal difficulties. An 80-pound girder rail is to be laid and the cars, which are to be handsomely furnished, will be heated and lighted by electricity. The cars are to be vestibuled, and will seat 32 people comfortably. The contract price for the first section from Brooklyn city line to Far Rockaway and the equipment is said to be $600,000. It is also stated that the road will be extended to Hempstead next year, and from Hempstead branches are to be run to Babylon on the south side and to the thickly settled sections of the north side, including Roslyn, Glen Cove and Huntington. The roadway has been paved through the village of Jamaica, and will be macadamized over all the sections outside of the large villages.

It is further stated that the managers of the new road include in their plans an arrangement with the farmers to convey their market produce in baskets by means of flat cars at night over any of the Brooklyn lines to any of the markets or stores in the city, and it is expected that this will prove a profitable line of business. It is proposed also to make arrangements with the large Brooklyn dry goods houses to deliver their goods to points out on Long Island at a very low rate and thus save the expense of running wagons to those sections.

Consolidation in Long Island City.

It is stated that a syndicate of Philadelphia capitalists has bought in five street railways in and around Long Island City, and will consolidate them under the name of the New York & Queens County Railway Company. The five railways which have been acquired had been on the verge of consolidation for some time, and the matter had previously engaged the attention of capitalists who are prominent members of the People's Traction syndicate.

The system comprises nearly 60 miles of trolley lines, nearly all double-tracked, including all the lines in Long Island City, its suburbs, and two or three neighboring Summer resorts. The five roads acquired are the Steinway Railway Company, of Long Island City; the Newtown Railway Company, the Pike Avenue & Sanford's Point Railway Company, the Long Island & Newtown Railway Company, and the Flushing & College Point Railway Company. In addition to the railways, the syndicate has acquired the Long Island City Illuminating & Power Company.

The capital stock of the new company will be $2,500,000 in 25,000 shares of $100 par, and in addition an issue of $2,500,000 5 per cent. 50-year gold bonds can be made. Of these issues the company will retain $500,000 in stock and $500,000 in bonds in its treasury. The bond issue, it is said, will be sufficient to cancel all the floating indebtedness of the five companies and provide for new equipment and extensions. Nearly the entire amount of bonds has been subscribed in Philadelphia, over $1,000,000 having been taken on Thursday.

The Brooklyn Fender Difficulty.

A resolution of the Brooklyn Board of Aldermen, directing the Corporation Counsel to appeal from Justice Neu's recent decision in the trolley fender case, has been vetoed by Mayor Schieren. The Mayor, in his veto message, says he believes that the decision referred to would be affirmed on appeal, but whether this is so or not, the practical effect of an appeal would keep the matter of a fender ordinance and its enforcement in abeyance for a considerable period to come. The principal consideration in the public interest is, he says, that there should be without delay a fender ordinance on the books, of unquestioned legal validity, and with provisions of the best practical character. He refers to an ordinance now pending which he believes will meet the situation.

A New Brooklyn Trolley Company.

The Brooklyn Bridge, Prospect Park & Eastern Railway Company has announced by public advertisement that it desires to become a corporation for the purpose of securing a franchise to construct a surface railway covering about 44¾ miles of track. Seventeen routes are fully outlined, and many of the streets for which application has been already made by the existing trolley companies, such as Monroe Street, Sixth Avenue, Woodbine and Pacific Streets, are included. The routes extend from the Bridge and ferries out to Flatlands. The following are included in the list of directors: A. N. Brady, of Albany, who is said to represent ex-Gov. Flower; Frederick S. Flower, Edward Browne, W. J. K. Kenny, and Ira A. Place. The amount of the capital stock is stated to be $500,000, divided into 500 shares.

A Storage Battery Road for Brookline.

It is stated that all the stock of the proposed Brookline Street Railway Company has been subscribed and that the construction of the road will be pushed forward. It is proposed to operate the road with storage batteries, and it is reported that arrangements have been made with accumulator manufacturers to furnish the entire equipment of the road, including furnished cars, and to operate the road for at least six months to the satisfaction of the company.

The storage battery people, it is stated, are so confident of the success of their system, which is the same as used upon the Madison & Fourth Avenue line in New York City, that they will put up a forfeit large enough to cover all costs of the equipment should it prove a failure. The directors of the railway company are William H. Lincoln, Martin P. Kennard, George F. Bouve, Walter Channing and Alfred D. Chandler, of Brookline; William A. Boland, of Lynn, and Samuel M. Jackson, of Newton.

Special Trolley Car Accommodations.

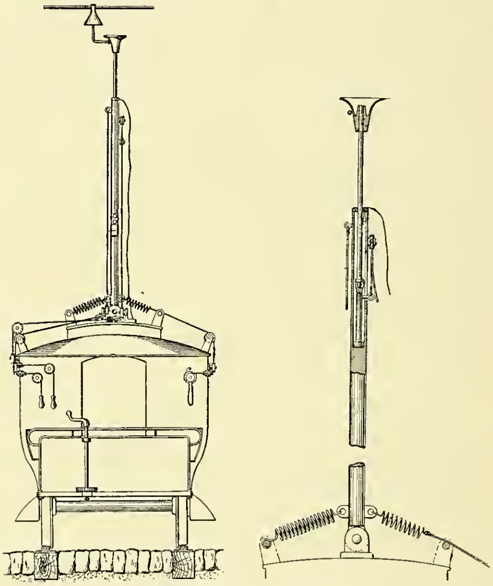
The Brooklyn Heights Railway Company has introduced a new feature on the Fulton Avenue line in the shape of trolley smoking cars. They will be painted red, so as to be easily distinguished, and will run on eight minutes' headway, from 6.45 to 9.30, a.m., and from 4 p.m. to 6.30 p.m., and during these hours no one will be allowed to smoke on the other cars on this line. Should the cars be well patronized, similar ones will be placed on the other lines. Another progressive departure from stereotyped street railway custom will be put into effect next week, namely, the provision of special cars for theatre parties. The new cars will be 25 feet long and have double trucks of four wheels each. The interiors will be finished off in hard wood, and will, of course, be lighted by electricity. The floors will be carpeted with heavy body Brussels, and silk and plush drapings and lace curtains will hang about the windows. There will be 50 rich plush-upholstered chairs of comfortable pattern in each car, and movable tables will add to the attraction and comfort. Each car will be provided with a buffet, and if passengers so desire they can have supper served in the cars.

It is probable that the cars will be popular with the theatre-goers, because of the fact that parties can go to the theatres in cars that are really warm, well-lighted and thoroughly comfortable. In one of these cars a party can attend a play and have a light supper of salads, etc., served in the car afterward, thus eliminating the objectionable feature of eating in a crowded restaurant.

Side-Contact Trolley.

We illustrate herewith, from the patent specifications, a side-contact trolley for which a patent was granted Nov. 26 to George Westinghouse, Jr., on an application filed June 13, 1890.

The trolley consists of a base-plate or step on top of the car, to which is hinged in suitable lugs, so as to swing laterally to the length of the car, a rigid arm or pole, which is further supported by pivoted braces to prevent motion longitudinally to the car. The upper end of the arm is made hollow or tubular, for the purpose of receiving a round rod or tube, which fits loosely enough within the bore to be capable of both axial and radial movement, and is provided at its outer end with an electrical contact piece or collector.



A SIDE-CONTACT TROLLEY.

The collector may be made of a tapering or inverted-bell form, having a wide flange to extend over the top of the line conductor with which it is used, in order to more certainly preserve contact. It is held against the side of the line conductor by one or the other of two springs secured at opposite sides of the arm near the lower end. One of these springs is normally stronger than the other, so that it has a tendency to draw the arm over in its direction and thereby cause it to bear against the opposite side of the conductor. When, however, it is desired to cause the arm to be drawn in the opposite direction to bear against the other side of the conductor, greater tension is put on the other spring by means of a cord or chain leading to a windlass or other place accessible to the motorman. To provide for variations in the altitude of the conductor, the rod of the arm may be raised or lowered by a cord leading to the platform of the car.

Street Railway Engineers.—XXIX.

ELMER A. SPERRY.

Mr. Elmer A. Sperry, the subject of this sketch, is one of the many electrical engineers who, after playing a prominent part in the electric lighting industry, finally succumbed to the attractions of the electric railway field. Mr. Sperry was born in Cortland, N. Y., Oct. 12, 1860, of American and German parentage; his father was a man of great mechanical skill, and his mother, of German descent, was a mathematical graduate from Rutgers College. His taste for electricity was acquired at an early age, as is indicated by the fact that he built an electric motor when but a child. His electrical education was obtained at the State Normal School at Cortland, and he subsequently attended at Cornell the lectures of Prof. W. A. Anthony on electricity and magnetism, which amounted practically to a course in electrical engineering, such as is now given separate places in the university and college curricula of to-day.

ELMER A. SPERRY.

The study of dynamo-electric machinery strongly engaged his attention from the beginning of his electrical career, and as early as 1878 he produced plans and drawings for a new type of dynamo. Patents for economic generation and automatic regulation were applied for in 1880 and 1882, and the Sperry system of arc lighting was first exhibited at Cortland on Christmas Eve, 1880. In 1883 a company was formed to place the apparatus on the market, and many plants on the Sperry system were installed. Mr. Sperry, however, did not confine his attention merely to questions of dynamo design, but the entire subject of electrical engineering claimed his attention. He instituted and personally operated, both as engineer and financial manager, the first of the large electric light stations of Chicago, all the lines being placed underground and covering a large district in the business portion of the city. Plans and specifications for some of the earliest of the large isolated plants of Chicago were also drawn by him. After meeting with great success the patents of the Sperry system were purchased by the Edison General Electric Company, which then instituted an arc-lighting department and began the manufacture of the Sperry arc machine, which plan was interrupted by the formation of the General Electric Company.

In 1892 Mr. Sperry turned his attention more particularly to electric railways, and at the Cleveland Convention of the National Electric Light Association of that year one of the exhibits which attracted much attention was that of the Sperry system of electric traction. After some roads had been equipped, the General Electric Company purchased the Sperry railway patents, as the Edison Company had previously done his arc light patents.

At the September meeting of the American Institute of Electrical Engineers, Mr. Sperry announced his system of electric brakes for street railways, the development of which has since that time occupied the greater part of his attention. The patents for this system were also purchased by the General Electric Company.

An Italian Electric Railway System.

Our French contemporary, *L'Eclairage Electrique*, refers to the enthusiastic accounts which have appeared in Italian journals of some experiments recently made at Rome by one Capt. Cattori, on what is stated to be a system which absolutely solves the problem of electric traction. In this system, the Italian journals state, the current is conveyed by the rails and returns by an insulated conductor, the object being to avoid the use of the movable contact trolley, which is not suitable for high speeds. The current is taken through the wheels of the electric locomotive which, for this purpose, are insulated from the metallic part of the car by wood, or the wheels are made of papier mache with metallic tires. The line of the road is divided in sections and the current distributed in series to all of the trains in motion. The Italian journal adds that this disposition has been adopted to avoid the employment of high voltages!

The Michigan Street Railway Association.

The Michigan Street Railway Association met at Grand Rapids, Mich., on December 4, and the street railway companies of Port Huron, St. Joseph, Benton Harbor, Battle Creek, Lansing, Bay City, Owasso, Corunna and Grand Rapids were represented.

Mr. Jay P. Lee, of the Lansing Street Railway Company, read a paper on franchises, and the committee on insurance, fire and accident submitted a report discussing quite fully the subjects under its charge. The construction and operation of street railways was also fully discussed.

The following officers were elected for the ensuing year: W. L. Jenks, Port Huron, president; W. Worth Bean, St. Joseph, vice-president; B. S. Hanchette, Jr., Grand Rapids, secretary and treasurer; E. E. Downs, Battle Creek, and Charles Swift, Detroit, were elected to form, with the officers of the association, the executive committee. The place of the next annual meeting was left to the executive committee, and the date fixed for the first Wednesday in next December.

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A SPEED-LIMIT INDICATOR.

It is frequently the case that railway managers issue positive orders limiting the speed at which their cars shall run, and sometimes go so far as to cut out the last controller notch so as to minimize the infractions of such orders. It is suggested that a simple device could be utilized as a tell-tale, to show at the end of the trip, for instance, whether a predetermined speed had been exceeded. Attached either to the car axle or the motor shaft, preferably the latter, a simple centrifugal governor could be placed, having a latching device so arranged as to lock the balls if they should spread out beyond a certain point. By simple adjustment of the mechanism it could be set to lock the balls whenever any given speed was exceeded. Of course, the entire mechanism should be enclosed and made inaccessible to any but the proper inspectors, the idea being to inspect the indicator at the end of each trip and keep a record of each motorman's service. The device would certainly be inexpensive, and is entirely practical.

ONE CLASS OF PROMOTERS.

There is a class of street railway promoter that should be carefully watched for by all interested in proposed roads, and by those who have the power to bestow franchises. He has several methods of ingeniously fleecing the public. If he is fortunate enough to get possession of a franchise, by either a show of resources or lavish promises, he usually has the game in his own hands; franchises are always valuable property, and there is always a market for a good one. But even if the franchise is worthless, by reason of a time limit or other considerations, the promoter is in nowise disconcerted. A stock company is speedily organized, and a road is built—but such a road! Discarded flat rails, double-reduction motors and old horse-car bodies figure conspicuously, if the promotor can get hold of them. A grand opening day is set; the road is usually in a small town where such an enterprise is a novelty, and the ramshackle cars are heavily patronized. The day's receipts are very flattering, and the stock is away up; the promoter has stock to sell, and at this favorable state of affairs takes good care to unload all that he personally possesses. Then he steps down and out, leaving the directors with a hollow farce on their hands. The promoter retires with a full pocket, and is difficult to bring to book, for he is always crafty enough to keep within the bounds of the law. This kind of shark is by no means new, but the public cannot be too frequently or too earnestly warned against him.

OVERLOADING RAILWAY GENERATORS.

A well-designed railway generator is usually rated so low that it can frequently carry as much as 50 per cent. overload for several hours. With large machines as much as 150 horse-power is consumed in heating losses, and of this at least 100 horse-power is located in the armature. In order to conduct this heat away large radiating surfaces and complete ventilation must be provided. With overloaded generators this heat is augmented till the temperature reaches a point above which the station manager does not think it safe to go. To meet such contingencies it is quite feasible to apply mechanical blowers to generators, and it is very easy to so design the generator as to allow cold air to be forced through every heated part. The Jumbo Edison dynamo carried a largely increased load with perfect safety by means of its mechanical blowers. Deliberate overloading is by no means to be commended on any score, but conditions frequently arise which make it not only advantageous, but imperative, and under such conditions the effects of the overload may be very materially mitigated by the practice suggested. For lessening the strain due to the peak of the load, for example, why is it not practical to provide a mechanical blower to force cool air through the machine? As a regular practice artificial cooling, of course, indicates poor design, for any dynamo should carry its rated load without it, but with station-load curves containing a few tall steeples it is certainly worthy of consideration.

THE TROLLEY DECISION.

The decision of Judge Townsend in the trolley case (Thomson-Houston Electric Company *vs.* the Winchester Avenue Railway Company) is the most important legal event that has yet occurred affecting the electric railway industry, and, if sustained, promises to introduce a complicated situation in that field. As the patent in suit was only issued in 1893, the effect of the decision will consequently extend until the year 1910. In another column we print the opinion of the Court in full, with the exception of some paragraphs having a purely legal interest, from which it will be seen that the decision sustaining the patent does not rest upon any fundamental principle of the trolley, but upon the "vital feature" of providing "for universal movement." In the opinion it is stated that the problem presented was the furnishing of a device capable of maintaining contact at great and varying distances above the car, and that the solution was accomplished by "a long, rigid arm, upwardly pressed and capable of universal movement." From this it would seem that the invention, in the eyes of the Court, consisted in the long trolley pole and the method of giving it lateral play. Somewhat singularly, the other patent in suit, which involved "the single feature of attaching the lower end of the spring to a rotating support, so as to move therewith," is declared void on the grounds that it is mere mechanical adaptation of a well-known device, though it is stated that without it the lateral movements of the swinging arm, which are considered so important, were interfered with. It would seem that the same line of reasoning might apply to the long trolley pole which superseded the trolley staging previously invented and free to the art, and also to the means for allowing the pole lateral play. The opinion has much to say of the numerous skilled inventors confronted by the problem of overhead contact, as if electric traction in its early days had been brought to a standstill by this condition. The study of patent opinions shows an attitude of the minds of courts with respect to the genesis of an industry, which, while it is perhaps natural on the part of the layman, is none the less an irrational one. The non-technical mind does not perceive that the growth of any new branch of industry must pass through all of its various stages, and cannot spring at a bound to a full development. Even if no invention is required at any stage of an art, it will present many problems for solution for which time will be required. The halting due to this, as well as to commercial impediments, is very apt to be regarded by the lay mind as evidence of great difficulties encountered, and natural advances, if coincident with the introduction of particular devices, are considered as due to the adoption of these. The case will, of course, be appealed, and, owing to the uncertainties so characteristic of patent litigation, the final outcome is almost as much a matter of doubt as it was before the date of the present decision. In the mean time its effect will be to direct greater attention to underground electric traction systems, and perhaps bring into prominence the "parallelogram" collector, which is used in Europe to some extent in place of the trolley. An illustration and description of the latter will be found in our issue of Sept. 28.

Long Island Traction Sold.

The sale of the Long Island Traction Company's property, consisting of securities and franchises, which was twice postponed by injunctions, took place on Friday, Dec. 13, at the New York Real Estate Exchange. There was only one bid, that of John G. Jenkins representing the Reorganization Committee, to whom the property was knocked down at $5,500,000.

The Committee of Reorganization of the Long Island Traction Company includes Frederic P. Olcott, Roswell P. Flower, Anthony N. Brady, John G. Jenkins, George W. Young, Marshall S. Driggs, and Alfred P. Pouch. This committee holds about 99 per cent. of the company's stock and about 95 per cent. of the company's debts. As soon as the committee receives title to the property, the company will be reorganized. The price which the property brought is sufficient to pay all the creditors of the company in full.

According to the plan of reorganization, as thus far perfected, the capital stock will be reduced from $30,000,000 to $20,000,000. To accomplish this each stockholder will be asked to exchange three of his shares of stock in the old company for two in the new. All the railways operated by the company, or whose securities the company holds, will be consolidated under the name of the Brooklyn Rapid Transit Company. Among the roads included are the Brooklyn Heights Railway Company, the Suburban Railway Company, and the lines of the Brooklyn City Railway. The new company will be organized under the laws of this State.

The Citizens' Committee and the Union Traction.

The sub-committee of five designated by the committee appointed under the resolutions adopted at last week's mass meeting to protest against eight-cent transfers called on President John Lowber Welsh, of the Union Traction Company, at his office, 304 Walnut Street, on Wednesday morning.

The members of the committee were greeted courteously by Mr. Welsh, who then asked the committee what he could do for them. Mr. Martindale, who said he had been president of last week's mass meeting, read the resolutions adopted there calling for the restoration of the old transfer system and proposing the sale of six tickets for 25 cents. In furtherance of the resolutions, Mr. Martindale said that the committee had been selected to wait on Mr. Welsh and ask what the sentiment of the company was in regard to the resolutions. Mr. Welsh replied that he had nothing to say.

" This committee," continued Mr. Martindale, " is desirous of securing justice for the people and the company as well, and desires to get some idea of the company's policy."

" We are doing the best we can for the people, the city and the people who have put money in the company," said Mr. Welsh.

" Have you considered the sale of six tickets for 25 cents ? "

" We have considered a great many things."

Mr. Martindale spoke of the specific demands of the resolutions and to their directing the committee to continue the agitation in case the company shall not meet the demands in a reasonable spirit. " My confreres and myself," he said, after some little discussion, " have tried to be conservative, and to limit this discussion to two points—a return to the old system of transfers and a basis of six tickets for 25 cents. You, no doubt, know what a hardship has been put on the people. We want to deal equitably with the company, but the people are aroused and want to secure concessions."

" There is no need of your making apologies," said Mr. Welsh. " We are finding no fault with any one. We have a large property and it will take time to properly perfect it. I have been connected with the company but a short time, having been before with the People's system. If you can find anything in any city superior to that system, its equipment, paving and service, I would like you to point it out. We find ourselves confronted with many things. As a Philadelphian, I have pride in my city, and believe in building it up. We have expended or will have expended $16,000,000 on the streets, and the real estate people and the people who walk have derived all the benefit. We occupy but one third of the streets. Have those who drive and ride bicycles on the other two thirds paid anything ? "

Mr. Richardson replied that the people give the streets and pay taxes.

Continuing, Mr. Welsh said : " If we have time we believe we will give the people the best railway system in any city. We propose to live up to all our contracts and give the men who have put money into the company a small return. I have had a little invested for two and a half years, and I have not yet received a cent out of it."

Mr. Penrose said : " I think the committee want to know if you will make any concessions, whether you will make any reply to the reasonable demands which have been made, in a reasonable time."

" We intend to do the best we can, as I have said," replied Mr. Welsh. " If you are not satisfied we will have to abide by what you decide to do."

Mr. Martindale called Mr. Welsh's attention again to the attitude which the people had taken at the mass meeting last week, and said the committee did not want to be put in the position of appealing to the public to pledge Councilmen to vote against the company and advocate the purchase of the railways by the city.

" I do not know what more we can do," observed Mr. Welsh. A member of the committee then suggested that if the three companies had continued independent there would have been no abolition of transfers, and Mr. Welsh replied that this did not necessarily follow.

The Philadelphia Traction Company, he continued, always charged 8 cents at many points, and no one could change from either of the other systems to the Philadelphia Traction lines for less than 10 cents.

" Public feeling," declared the member, " has been aroused. We believe that we represent the great body of the people. Our immediate application is for you to consider the restoration of fares as they were before." To this Mr. Welsh replied that his company tried to conduct its business in the way that is best for the city, the people and those who have put their money in.

" And if the people do not like it they can walk," observed Mr. Martindale.

" That is what you say," said Mr. Welsh warmly.

" What is the total capitalization of the company ?" asked Mr. Martindale. " I understand it is about $129,000,000." Mr. Welsh said he did not know exactly, but could give it to the committee from the books.

" Approximately, I mean," said Mr. Martindale ; " within a million or so. I don't care if it is not nearer than ten or fifteen millions."

" But I care," was Mr. Welsh's reply.

" We claim," said Mr. Welsh, again taking up the subject, " that it will take two years to work out the system to the standard we have in view. We believe that we are now giving more than the railways of other cities."

" That is to say, it will be two years before the fares are reduced," said Mr. Martindale.

" I did not say so," said Mr. Welsh.

" We are trying to elucidate something about your policy, and you seem to decline to justify your present course and to say what you have in view."

" I thought the meeting was one," was the reply, " where you desired to make a statement to the Union Company. We say we are giving the best we can. What would you do ? "

" I," replied Mr. Charles Emery Smith, " would do everything to satisfy the demands of the people."

" We have to consider the people who put money in. Don't you want to get money out of your newspaper ? Are the trolleys to have nothing ? "

" Don't you think," asked Mr. Richardson, " that 40 per cent. is a good deal of profit? "

" I have never received 40 per cent.," replied Mr. Welsh quickly. " A few years ago," he continued, " you all fought the electric roads, and you are doing it now. Instead of facilitating travel, you block the cars when thousands of people are riding and interfere with their running simply out of a spirit of hatred. Is any effort made to educate the people so as to facilitate travel? If you can tell us how to run this system we will be glad to have you here and go over the problems from early morning to night. Your interest is great; now give us your efforts. I have been at this, day in and day out, Winter and Summer. I receive you as courteously as I can, and ask you to do for this city all you can to build it up. Don't drive capital away. Bring people here who have incomes and keep them here to spend their incomes. Give us a little encouragement. We have opened 200 miles of road for eight cents. You talk about those who pay more than they did, but what about those who do not pay as much?" Mr. Penrose remarked that they had not been heard from, and Mr. Welsh replied that they never were heard from.

"Why don't you run larger cars?" asked Mr. Richardson. "You will have to ask our engineers," said Mr. Welsh. "Our people say the cars are the proper size. If you will show us how to do this, how to put in rails for L lines in a day, we will pay you well. If I live and remain in this company, I will fight to one end, and that is that this city shall have the finest system of surface roads existing. We will live up to our contracts with the city, and make a moderate return to those who have put up money for two and a half years without receiving a cent. There is no philanthropy and no widows and orphans in this; it is pure business. I have nothing to do with my predecessors. I am speaking for the Union Company." Mr. Welsh said that when his people took hold of the People's road they were told how to make money. They did not agree, but concluded to give the people good cars, well heated and lighted, and he was sure every one will agree that the equipment and service of the old People's system leaves nothing to be desired. Mr. Martindale assented heartily to this, but remarked that that comprised a few lines only. Mr. Welsh replied that his connection with other lines had been short.

Mr. Penrose remarked that the people would not pay the increased fare indefinitely, and Mr. Welsh replied: "If we are not able to carry out what we want to do we will have to go into some other business. If you take our business away that ends it."

To a remark about the street paving which had been done by the companies, Mr. Welsh replied that if the work had not been properly done the city was to blame, because its inspectors watched all the work. The streets, he declared, were much better than before, and the committee admitted that point.

Mr. Martindale referred to the subject of cars without licenses and to the ordinance requiring fenders. Referring to licenses, Mr. Welsh said that the Union Traction Company would pay all the licenses the law required, and as to fenders, if the city officials would go to other cities and find a better record than the old People's system can show, the Union Traction Company will adopt whatever fender or device that made the superior record.

After considerable further discussion Mr. Martindale asked finally if Mr. Welsh would ask his board to formulate some reply to the demands of the committee, and Mr. Welsh said the board had asked him to state what the company was trying to do, and he had told the committee all he could.

Comments and Views of Contemporaries.

Street Railway Securities as Investments.—No one needs to be told that street railway securities are attracting greater attention than ever before. This arises, of course, from the growth and extension of the street railway system under the application of electricity and other forms of mechanical traction. Since the advent of the trolley, millions upon millions of dollars have gone into that field of investment—in part to convert old horse-car lines into electric or cable roads, in part to build new lines, both in the cities and towns and across the country. Street railway properties have long been favorites with certain classes of people, but until the introduction of electricity the interest in them was mainly local.—*Financial Chronicle.*

Responsibility for Accidents.—Scarcely a day passes that a report is not received of a more or less serious personal injury accident resulting from the high rate of speed of the trolley cars. The disposition is general to blame the street car companies. The same popular sentiment blames the street car companies for taking up the best part of the city's finest streets. The blame, if there be any, is wrongly placed. It is the public that demands the high rate of speed, and in a measure it is only the public that demands that streets shall be occupied by street railway tracks. The companies are to be blamed only when they do not exercise proper precautions to prevent maiming or killing persons. That they do this should be clear from the simple fact that each accident is very expensive to the company responsible. Damage suits are dear and regrettable incidents in their business.—*Detroit Journal.*

The Relation of Electric to Steam Roads.—The determination of the Illinois Central Railway to follow the example of New England railways and equip all of its suburban railways with electricity, tends to confirm the statement made by this paper that in the near future electricity would supplant steam as a motive power on all the minor or unimportant railways of the country. The experiments made in operating the smaller suburban roads of New England with electricity proved the practicability, the cheapness, and the efficiency of the motor system, which has very generally been substituted on such roads for steam power. The Illinois railway is moved to substitute electricity for steam by a determination to pre-empt the field before it was certain to be occupied, and successfully too, by the electric companies. The fact that the managers of steam roads are not greatly alarmed over the progress made in the adoption of electricity as a motor power is accounted for in the belief expressed that the suburban and side electric roads will bring to the steam roads both freight and passenger traffic that they would not otherwise get, and will thus save them the necessity of building side lines themselves to open up the territory of which the electric roads are the feeders of the steam roads. —*Syracuse Courier.*

A Severe Test of Electric Elevated Traction.

On Nov. 25 last a most furious snow storm visited Chicago; the wind blew in a gale, bringing with it first snow and then rain, and Chicago was turned into a sea of impassable slush. The temperature dropped below freezing point, and the moisture which collected on the roofs and walls and in the streets became a solid mass of ice upon which for hours beat hail and sleet. Surface transit was completely stopped; not a trolley car, cable car or horse car moved except at very long intervals and with the greatest difficulty. The residents on the outskirts of Chicago could not reach their homes, and the night population of Chicago became, for this occasion, far beyond the normal. Those, however, who lived along the lines of the elevated roads found some relief. By dint of hard work the roads operated by steam were able to get trains through, but not without considerable delay, the tracks being blocked by fallen poles and wires.

The sole exception, in all this period of abnormal conditions, was the Metropolitan Elevated Railway, which is operated entirely by electricity. No stoppage of moment occurred on this line, and the trains ran under a shortened headway, satisfactorily carrying, not only the ordinary quota of passengers, but thousands of those who usually depend upon the surface lines to take them home.

Throughout the entire duration of the storm, service on the Metropolitan Elevated Railway suffered only two short interruptions. The first lasted nine minutes—the road being rendered impassable on account of a fire in a building adjoining the track. The second interruption, of five minutes, was occasioned by a slight defect in one of the cars.

This severe storm, made up of almost every kind of climatic unpleasantness imaginable, put the electric elevated railway to the severest test that could have been conceived. And yet, in spite of the difficulties which put a stop to surface transit, and interrupted for hours the steam suburban traffic and the steam elevated roads, the electric elevated system was not seriously affected. Such a record as this especially emphasizes the superiority of the electrically operated road over roads operated by steam, and serves also as an object lesson by which the elevated roads in New York and Brooklyn might materially profit.

The Hascall-Richards Steam Generator.

It has long been recognized by steam engineers that in the construction of a boiler the point of greatest importance is the circulation, other factors being subsidiary matters of constructional detail and simple calculation. Several years ago Mr. J. J. Bush, appreciating this fact, devised a simple apparatus by means of which theoretical considerations in this respect could be realized, and of such a construction, moreover, as would enable it to be easily applied to usual forms of boilers already in use. Some seven years ago the invention of Mr. Bush was applied, though in a somewhat crude form, to one of the boilers of the steam plant of the American Grocery Company, of New York. When recently inspected by the writer, the generator was still in excellent condition, and the engineer in charge spoke highly of the good service which it has rendered. A later form of the same apparatus has been applied to other boilers of the same plant, with the result, according to the engineer, of increasing their capacity 30 per cent. and reducing the consumption of coal.

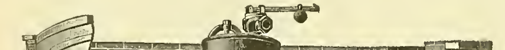


FIG. 1.—SHOWING LOCATION OF GENERATOR.

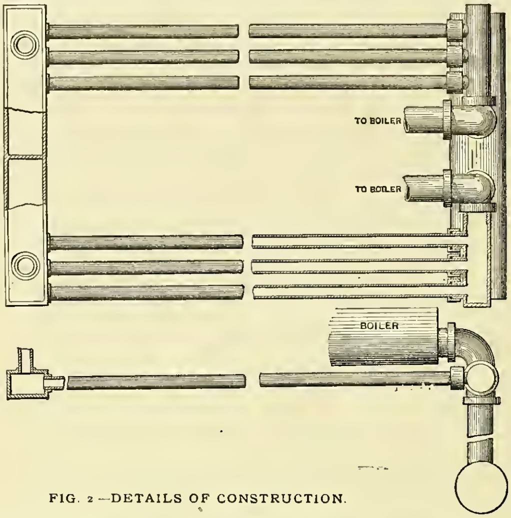


FIG. 2.—DETAILS OF CONSTRUCTION.

The accompanying illustrations clearly show the principle and application of the apparatus, which consists of three or more parallel tubes of 2½ inches in diameter, or thereabouts, located on each side and in line with the bottom of the boiler, and, of course, subject to the most intense heat of the furnace. At the rear end and at the bottom of the boiler (see Fig. 1) the water enters the tubes through an expansion header, which provides slip joints to accommodate expansion and contraction of the generator pipes; at the other end of the boiler there is a partitioned water box, which is connected to the front boiler space above the water level, as shown in Fig. 2. There is a gravity mud drum beneath the rear water chamber, to collect sediment and remove scale-forming constituents of the water.

It is at once evident that the intense heat to which the tubes are subjected will set up a rapid circulation of water in the boiler, and in a direction from the rear to the front. This is of particular service in getting up steam, for it not only reduces the time to a minimum, but obviates injurious strains. In marine practice it has been found advisable to provide for the latter difficulty by artificial circulation during the time of raising steam, so that the Bush apparatus also includes the function of the marine "Hydro-Kinetor." It will be noticed that the direction of circulation is a natural one, from a lower water level at the rear and in the direction of a progressively increasing temperature to the steam space in front.

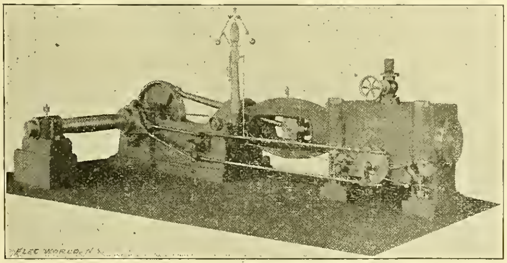
Among the noteworthy details are the expansion headers, with slip joints at the rear of the boilers, which allow for the contraction and expansion of the generator pipes, thus avoiding harmful strains. The front chamber is so placed as to dispense altogether with the usual front arch, which is a matter that will be appreciated by engineers. The water boxes are partitioned, thus forming distinct chambers and securing an independent and uniform circulation through the tubes on each side of the boiler and in the boiler itself, and this irrespective of the different temperatures to which the several tubes are subjected.

The apparatus can be applied in a few hours to any of the usual forms of boilers without removing the masonry work. Among the claims made by the manufacturers, the Hascall-Richards Steam Generator Company, 36 Bromfield Street, Boston (who have secured the services of Mr. Bush as general superintendent and acquired his patents), are, that the apparatus increases the capacity of any boiler to which it is applied, from 10 to 33⅓ per cent., according to varying conditions; prevents foaming and deposit of scale and removes sediment; prolongs the life of the boiler and introduces no changes of conditions as to firing or operation of the steam plant; and, finally, causes a saving of coal of from 10 to 30 per cent., according to the conditions existing, the saving specified for any given case being guaranteed by the makers of the apparatus.

The Slater Engine.

Of the releasing-gear steam engines that have been placed on the market the last few years, the Slater engine, built at Warren, Mass., and for which W. D. Hoffman & Co., 620 Atlantic Avenue, Boston, are selling agents, contains several features of particular interest.

In general design the engine frame is similar to the Tangye type, with bored or milled guides, the guide piece being removable for convenience in shipping, erecting and repairing. The cylinder, however, is a special design, and embodies the most advanced practice. The steam and exhaust valves for each end are fitted to a separate piece, which constitutes the main cylinder leg and the two chests, steam and exhaust. These end pieces are bored large enough to receive the barrel of the cylinder, this barrel being, as in marine practice, a separate piece, and so arranged that should it be injured or cut by any accident, it can be replaced without the expense of replacing the steam and exhaust chests, cylinder legs, etc. The exhaust valve is of the Corliss type, with three ports instead of one, and the exhaust valve seat is separate from the cylinder leg, being so arranged that it can be removed and repaired when necessary by simply facing off the seat, which is, of course, circular in a small lathe. The steam valves are placed on the side of the cylinder, and the seats of these are also separate from the cylinder leg, so that they can be removed and repaired without disturbing the cylinder and cylinder legs in any way. The steam valve is a flat, multiported valve, and the stems of these valves are attached directly to the lifting yoke of the cut-off motion. As they fall of their own weight, supplemented by steam pressure, very small dash-pits suffice. The two eccentrics, one for the steam and the other for the exhaust valves, can each be adjusted independently of the other, so that the steam lead and the exhaust compression can be fixed at any desired point according to the speeds and other conditions required. Both eccentrics are arranged with hooks for disconnecting when working by hand. There are, of course, two wrist plates, one each side of the cylinder, the steam wrist plate being on the shaft side of the engine. The cut-off motion consists of three pieces for each steam valve, the reach rod from the wrist plate to the bell crank, the bell crank which is inserted in the lifting yoke, and the governor trip arm. The trip arm is mounted on anti-friction balls, as are the two arms of the governor connecting with the trip. The wrist plates have just one third of the oscillating motion usually given to a regular Corliss wrist plate. Under these conditions it is obvious that the engine can be run at a moderately high speed when necessary. That is to say, a 42-inch stroke engine will run 100 revolutions per minute and the 36-inch stroke engine 125 revolutions per minute, without any undue stress on any part of the valve motion. The usual speed of these engines is, however, from 80 to 100 revolutions per minute.



SLATER ENGINE.

The engines are built exceedingly heavy, and are well suited for railway and other severe work. The regulation is very satisfactory; there is attached a device to prevent the engine from running away and wrecking itself. The engines are built horizontal and vertical, as may be required, in tandem, cross-compound, triple or quadruple, and are fitted on the interchangeable system in the shops, which insures the greatest accuracy.

Some Attractive Specialties.

Among the numerous specialties which the Fiberite Company, of Mechanicsville, N. Y., is putting out, are the sleet-cutting trolley wheel and pony switch shown in the accompanying illustration. The wheel, as will be noticed from an inspection of the cut, is provided with radial cutting ridges on the inner face of the flanges, and the flanges have holes cored in between these ridges to facilitate the disposal of the sleet-cuttings. The wheel is substantially made, and it is claimed by the makers that it has given entire satisfaction wherever it has been used.

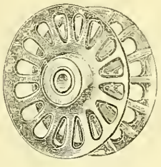


FIG. 1.—TROLLEY WHEEL.

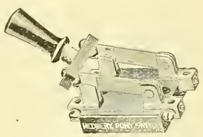


FIG. 2.—LONG SWITCH.

The pony switch shown in Fig. 2 is a compact, stoutly built little device, and has received just as much care in design and manufacture as is bestowed upon larger and more important switches. The base is of polished slate, the blades of rolled copper, and the fittings are polished bronze.

FINANCIAL NOTES.

THE HAGERSTOWN & POTOMAC ELECTRIC RAILWAY COMPANY has filed a $200,000 mortgage to secure an issue of bonds.

UNION TRACTION CERTIFICATES.—The 4 per cent. Union Traction certificates, which are exchangeable for the stock of the People's and Electric Traction Companies, have been issued.

THE COLUMBUS STREET RAILWAY COMPANY reports a comparative decrease in net earnings for November of $1,926.04 ; for the eleven months ended Nov. 30, a comparative increase in net earnings of $18,186.

THE MILWAUKEE STREET RAILWAY COMPANY.—The earnings of the Milwaukee Street Railway Company the year ended Dec. 1 were $1,286,880, according to the statement submitted for taxation purposes.

WASHINGTON, D. C.—The Maryland & Columbia Railway Company has executed a mortgage to the Central Trust Company, of New York, to the amount of $6,000,000 to secure a proposed issue of 5 per cent. J. & D. gold 50-year bonds of the electric railway between Washington and Baltimore.

THE PITTSBURG CONSOLIDATION. — Stockholders' meetings have been called for Dec. 23 by the Pittsburg, Allegheny & Manchester Traction Company, the Pittsburgh Traction Company, the Central Traction Company and the Duquesne Traction Company to ratify the lease of these various lines to the Citizens' Traction Company.

PORTLAND, ME.—The Portland & Cape Elizabeth Railway Company has filed at the City Clerk's office a trust mortgage on its property to cover an issue of $400,000 worth of bonds, to be dated Nov. 1, 1895, and to bear 5 per cent. interest. The provisions are that $250,000 worth of bonds shall be at once placed at the disposal of the company ; $50,000 shall be delivered from time to time, and $100,000 shall be delivered when the company has 15 miles of track in operation. The company is now ready to operate a road between Cape Elizabeth and Portland.

WILKES BARRE TRACTION BONDS SOLD.—The Wilkes Barre & Wyoming Valley Traction Company has recently placed in New York $200,000 of its 5 per cent. semi-annual gold bonds, these being the balance of a total issue of $325,000, of which $125,000 was taken by local bidders. These bonds are secured by a first mortgage on the road whose gross earnings since 1892 have gone from about $135,000 to about $444,000, and its net surplus earnings, over and above all charges of every nature, having gone from about $44,000 in 1892 to about $110,000 in 1895.

AKRON, O.—Details of the street railway and electric light plant combination under the New York syndicate have been made public. The new company will be called the Akron Street Railway & Illuminating Company, and will be incorporated for $1,500,000. W. D. Chapman, of this city, will be made manager. One of the two plants will be abandoned and an emergency fund of $400,000 will be created. This fund, it is given out, will be used to purchase the Akron & Cuyahoga Falls Rapid Transit Company, which has lines in operation to Barberton and Cuyahoga Falls, and one practically completed to Kent, and is on the eve of securing valuable franchises in this city.

PATENT SUIT AGAINST THE UNION TRACTION COMPANY.—Suit was entered in Philadelphia on Tuesday by Alfred H. Williams and W. M. Schlesinger-Selwyn against the Union Traction Company for alleged infringement of patent, the plaintiffs claiming to own patents covering the division into sections of the trolley wire and feeding of each section by an individual feeder which includes in its circuit a safety device. In the bill filed against the Union Traction Company, the Philadelphia Traction Company, which forms a part of the Union Traction Company, is exempt from liability under the suit, for the reason that while they were operating independently suit was brought against them for infringement of this patent, and after considerable testimony was taken the suit was settled by the Philadelphia Traction Company buying a license under the patent.

OTTAWA ELECTRIC RAILWAY SOLD.—The Ottawa Electric Street Railway was sold at auction last week by Special Commissioner A. F. Schoch, under an order of the United States Circuit Court, the purchaser being the General Electric Company, who made the only bid. Mr. Schoch was appointed receiver on Oct. 28, having been agreed upon by the bondholders and stockholders. The latter, who were all Chicago and Council Bluffs people, were in a wrangle over the management of the road. As a result of their disagreements the company made no efforts to run the road with any system, the rolling stock was not kept up, and no improvements were put in. Ten months ago operations were entirely suspended. Attempts of the citizens to purchase it have met with no results, as the stockholders could not agree on terms. The sale enables the General Electric Company, which has always been willing to sell, to deal direct, and it is probable the citizens will purchase, equip and operate the road. The railway, which is seven miles long, was built six years ago at a cost of $107,000. It was sold for $7500.

NEW INCORPORATIONS.

MONTREAL, CAN.—The Sherbrooke Street Railway Company has received its papers of incorporation from the government.

BELLEVILLE, ONT.—The Belleville Traction Company has been incorporated, with a capital stock of $100,000, for the purpose of constructing and operating an electric railway in this city. The incorporators are T. C. Lazier and R. E. Lazier.

ALLEGHENY, PA.—The Allegheny & Evergreen Street Railway Company has been formed by H. C. Bolster, William L. Hartmeyer, J. C. Eckerman, of Allegheny, for the purpose of building an electric street railway in Allegheny County. Capital stock, $30,000.

PORTLAND, ME.—The Standard Electric Car & Power Company has been incorporated to develop a certain invention in electrical railways and cars therefor. The promoters are Lewis A. Drake, John K. Wightman, Boston, Mass., and Leon O. Dion, Natick, Mass. Capital stock, $500,000.

SAN FRANCISCO, CAL.—The Electric Railway Hill-Cable Company has been formed to construct and repair cable and electric railways, purchase patent rights relating to railways, etc. Those interested are N. W. Griswold, William H. Birch and John L. Boone, San Francisco, Cal. Capital stock, $1,000,000.

PORT JERVIS, N. Y.—The Port Jervis Electric Street Railway Company, capital stock $70,000, has been incorporated for the purpose of building and operating a street surface road seven miles long in Orange County. Those interested are S. D. Lake and A. C. Haines, of Port Jervis, and Lafe Pence, New York City.

BROCKVILLE, ONT.—The Brockville Electric Street Railway Company, capital stock, $200,000, has been incorporated for the purpose of constructing an electric railway which is permitted to extend a mile and a half beyond the limits of the town. Those interested are W. H. Comstock, W. A. Gilmore, C. A. Cossitt and G. M. Booth, all of Brockville, Ont.

BROOKLYN, N. Y.—The Brooklyn Bridge, Prospect Park & Eastern Railway Company has been organized for the purpose of operating a street surface road 44 miles long in Kings County. The promoters are A. N. Brady, Albany ; E. S. Flower, New York City ; J. J. Kane, New York City, and Edward Browne, New York City. Capital stock, $500,000.

CHARLESTOWN, W. VA.—The Milner Electro Gravitation Motor Company has been formed for the purpose of manufacturing and dealing in motive-power machinery and engines of all kinds, etc. Those interested are William E. Conway, Silas H. Berry, James F. Atkinson and Thomas Hanson, Brooklyn, N. Y. Capital stock, minimum, $500; maximum, $5,000,000.

ST. CATHARINE'S, ONT.—The Lincoln Street Railway, Traction & Light Company has been formed to build and operate an electric railway in St. Catharine's, and not further than a mile and a half beyond the town limits; also to distribute electricity for light, heat and power. The incorporators are R. H. Hill, H. A. King, of Toronto; J. S. Campbell, Dr. L. S. Oille and George E. Patterson, of St. Catherine's. Capital stock, $90,000.

WEST ORANGE, N. J.—The Orange Mountain Traction Company has been organized to purchase and take over the property and franchise of the Orange Mountain Cable Company, a corporation incorporated under the laws of New Jersey. The promoters are Walter C. MacFarland, 142 South Fourth Street, Philadelphia; William S. Hood, 607 North Second Street, Camden, N. J., and Leonard C. Dodge, 2236 Mt. Vernon Street, Philadelphia, Pa. Capital stock, $150,000.

NEWS OF THE WEEK.

HOLMESBURG, PA.—The Holmesburg, Tacony & Frankfort Electric Railway Company will extend its line to Trenton, N. J.

TORONTO JUNCTION, ONT.—Tamblyn & Gibson, of this town, have the contract for extending the Suburban Electric Railway to Weston.

RED BANK, N. J.—The application of the trolley company for right to build its road on Shrewsbury Avenue, to the Rinton Falls road has been granted.

MARLBOROUGH, N. Y.—It is proposed to build a trolley road from Marlborough to Newburg, to be called the Newburg Electric Railway Company.

NEWTON, MASS.—There seems to be some opposition to the proposed line of the Newton & Needham Street Railway Company through Paul Street.

SEWICKLEY, PA.—The Ohio Valley Street Railway and the Coraopolis, Sewickley & Economy Street Railway Company are seeking franchises in Sewickley.

MONTICELLO, N. Y.—The new electric road to be constructed in this place will probably be known as the Monticello, White Lake & Neversink Valley Traction Company.

VICKSBURG, MISS.—The Vicksburg Electric Transit & Light Company is in the market for two 125-hp generators, two 150-hp high-speed engines and five motor cars.

GOSHEN, IND.—The Indiana Street Car Company will erect a temporary building to be used as a car house until next Spring, when a modern brick building will be erected.

DUNDAS, ONT.—The residents have approved of the Port Perry & Kincardine Electric Railway scheme, and the sum required from the municipality has been subscribed.

BATH, N. Y.—The Corning & Painted Post Electric Railway Company will probably build a road from Bath to Hammondsport. The manager of the company is C. W. Prince, Corning, N. Y.

ST. LOUIS, MO.—It is reported that the People's Railway Company will make a test in the immediate future of the conduit system with a view to equipping its whole system on this plan.

HOLYOKE, MASS.—The Holyoke Street Railway Company is making repairs and changes in its line to Chicopee Falls, and is considering the matter of extending the line to South Hadley.

BROOKLYN, N. Y.—The Atlantic Avenue Railway Company has applied to the Common Council for a franchise for a double-track road on Bergen Street, from Rochester to Rockaway Avenues.

ST. LOUIS, MO.—The Fourth & Arsenal Street Railway Company has been organized, and will let contracts for a trolley line. Charles Green is president, and Charles J. Maguire, secretary.

MILLEDGEVILLE, GA.—The Old Capitol Railway Company is to be reorganized. A sale of the road will be made, a new company formed, and the road will be rebuilt and put in first-class condition.

PLATTSBURG, N. Y.—T. F. Conroy, of Plattsburg, has purchased Ausable Chasm, including hotel and about 500 acres. It is expected that a trolley system will be built from Plattsburg to the Chasm.

GORHAM, ME.—At a special town meeting it was resolved unananimously that public convenience demands the construction at the earliest possible date of an electric road from Westbrook to Gorham.

CINCINNATI, O.—The Consolidated Street Railway Company has been granted permission by the Board of Aldermen to put up trolley wires. This does away with the last horse-car line in this city.

BROOKLYN, N. Y.—The Brooklyn City Railway, the Kings County Electric, the Brooklyn City & Newtown and the Brooklyn Heights Railway Companies have made application for extension of routes.

LACHINE, QUE.—The manager of the Park & Island Railway met the Lachine Council recently, and submitted plans of the road as it is to enter Lachine. Active work on the road will soon be commenced.

MIDDLETOWN, CONN.—It is reported here that the New York, New Haven & Hartford Railway Company intends to build a trolley road from Cromwell to Middletown, in connection with the Meriden & Cromwell Railway.

BATAVIA, N. Y.—The Aldermen have voted to grant the request of A. B. Wilgus for an extension of franchise for an electric railway, and he will be given until Aug. 1, 1896, to complete the road and have it in actual operation.

SOUTH ORANGE, N. J.—The Newark & South Orange Railway Company is desirous of constructing and operating a double-track railway, to be operated by electricity, along Valley Street, from South Orange Avenue to the village line.

WESTFIELD, MASS.—The 41 shares of additional stock of the Woronoco Street Railway, authorized by the State railway to be issued for extending the line and equipping it with electricity, were sold at auction recently, as required by law.

OMAHA, NEB.—The management of the railway company is preparing to put into use on the Omaha branch of the line single motor cars instead of the motors and trailers now in use. It has been decided to abandon the trailers entirely.

PITTSBURG, PA.—An ordinance has been presented before the Council granting the Birmingham Street Railway Company the right to enter and occupy certain streets and highways, beginning at the eastern terminus of Arlington Avenue in this city.

BALTIMORE, MD.—A deed has been placed on record under which, in consideration of $5000, the Frederick Turnpike Company grants to the Baltimore-Catonsville Passenger Railway Company the right of way for the construction of the new rapid transit line.

BLOOMSBURG, PA.—Major E. C. Hamilton, of Shamokin, and G. M. Smith, of the Shamokin & Mt. Carmel Electric Railway Company, Philadelphia, have been in Bloomsburg in the interest of an electric street railway in this town, and extending to Berwick.

SAN RAFAEL, CAL.—S. B. Cushing is interested in the Tamaltis Mountain Railway, to be built from Mill Valley to the summit of the mountain, a distance of seven miles. The grade is about 7 per cent. The engineer in charge is G. B. Avery, San Rafael.

SALEM, O.—The stockholders of the Salem Power & Light Company and the Salem Electric Railway Company will hold a joint meeting for the purpose of consolidating both concerns. Should the consolidation be consummated considerable improvements will be made.

PORT RICHMOND, S. I., N. Y.—Port Richmond trustees have granted the franchise on Richmond Avenue to the Staten Island Electric Company, under condition that the Midland Company should have common trackage over the short line from Jewett Avenue to the Bergen Point ferry.

AKRON, O.—The County Commissioners have granted Thomas F. Walch, manager and superintendent of the Akron & Cuyahoga Falls Rapid Transit Company, a franchise for an electric railway from Barberton to Hametown. The proposed line will also run to Wadsworth in Wayne County.

GREENSBURG, PA.—The decision of the Supreme Court favoring the Greensburg & Jeannette Electric Company on its bridge dispute with the Pensylvania Company created a good deal of satisfaction here and at Jeannette, and it is stated that the work of extending the road to Turtle Creek will be taken up immediately.

PROVIDENCE, R. I.—At a recent meeting of the Common Council a petition was submitted signed by 200 residents asking for the extension of the Admiral Street trolley line to the upper junction of Veazie Street. It is understood that the managers of the Union Railway Company are willing to grant the request if the City Council approves the petition.

HULL, QUE.—The Quebec Government has been asked to grant a charter for an electric railway to extend from Montebello to Hartwell, a distance of 30 miles, the company to be known as the County of Labelle Electric Railway Company. Mr. Poulin, of Montebello; Joseph Bourque, of Hull; and Rev. Father Rochon, of Papineauville, are the promoters.

WASHINGTON, D. C.—The Washington & Mount Vernon Railway Company began the work of laying tracks for the entrance of its lines into Washington this week, and the work is to be completed by the first of January, 1896. Arrangements have been made with the Pennsylvania road by which the Mount Vernon road is to enter the city by way of the Long bridge.

SAN BERNARDINA, CAL.—There is a movement on foot to convert the E Street road into an electric line. The road runs from the Santa Fe depot to the business portions of the city. It is believed that the Santa Fe Road is behind the deal and will run the electric road in connection with its trains to offset the advantage the Southern Pacific has in its contrally located depot.

WASHINGTON, D. C.—The Capital Traction Company has had a bill introduced in the Senate to amend the company's charter so as to permit an extension from Seventeenth Street and Pennsylvania Avenue along G Street to the river, and return tracks by way of F Street to Seventeenth Street. Also to run along Twenty-second Street, between the river and Florida Avenue.

WHITE PLAINS, N. Y.—The New York, White Plains & Elmsford Trolley Company has filed plans for several extensions. One branch is to go to the Scarsdale line, where it will connect with the North Mt. Vernon line; another to the railway station at Hartsdale, a third, which will be carried out first, is to run to Mamaroneck. The company also intends to extend its lines from Elmsford to Tarrytown.

WINDSOR LOCKS, CONN.—The Windsor & Suffield Tramway Company will build its projected electric railway to either Rainbow or Poquonock, at a cost of $30,000. This company was incorporated in 1893, with a capital stock of $50,000, and among the parties interested are David Henney, president of the Hartford & West Hartford Horse Railway Company, Farmington, Conn.; H. C. Douglas, Windsor Lock, and William R. Hurd, Bristol, Conn.

WAUKEGAN, ILL.—It looks as though the proposed Chicago & Wisconsin Inland Lakes Electric Railway would be an assured fact. The work of securing the right of way is progressing. The road is to reach Chicago over the Milwaukee & St. Paul tracks, and from Libertyville the electric line will begin, crossing the Wisconsin Central at Grays Lake. It will pass along the eastern side of Fox Lake, with a station near the Columbia Club. Thence it will run north to Wilmot, Wis., where, at present, negotiations for the right of way are in progress.

ROXBOROUGH, PA.—Residents of Manayunk and Roxborough, who patronize the Wissahickon Electric Railway, are exercised over an announcement that the railway company is contemplating the discontinuance at the end of the present month of the seven-cent transfer tickets over the Roxborough, Chestnut Hill & Norristown Traction Company's line. The company, it is said, claims that only passengers going from Manayunk to Roxborough purchase the transfer to ride up the steep hills, while persons from Roxborough, instead of riding to Manayunk, walk from Ridge Avenue down the grade. The expense of the transfer system, it is claimed, falls chiefly upon the Wissahickon Company.

MONTREAL, QUE.—The Napierville Junction Railway Company, which is chartered to carry freight and passengers, will run from St. Remi to Stottsville, through the parishes of St. Michel, St. Phillippe, St. Jacques, Douglassburg and Napierville, connecting with the Grand Trunk Railway at Stottsville. The Dominion Government has granted a bonus of $3200 per mile, and the following amounts have been promised by the municipalities named to assist the enterprise: Napierville, $10,000; St. Edward, $2500; and St. Remi, $2000. Hon. J. C. Laviolette is president of the company, and Mr. Eugene Lafontaine is secretary. Among the directors are Messrs. L. G. Peltier, M. P. P., and Gen. Riley, U. S. Consul at Ottawa. It is expected that the line will reach St. Edward by Christmas, and that the whole line, 22 miles, will be completed by next July.

TRADE NOTES.

A. O. SCHOONMAKER, 158 William Street, New York, reports an increasing demand for his solid sheet mica segments and states that he is now prepared to stamp mica washers of all sizes.

THE BERLIN IRON BRIDGE COMPANY, of East Berlin, Conn., has just completed for the Standard Oil Company, at Constable Hook, N. J., a compounding building 120 feet wide by 130 feet long. The roof trusses are composed of steel, with steel purlins and covered with galvanized corrugated iron.

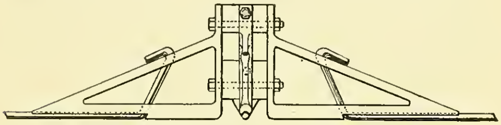
THE JOWITT CARBONIZED FELT COMPANY, 66 Maiden Lane, New York, is receiving very gratifying testimonials concerning its carbonized felt roofing, which seems to have been found highly satisfactory by railway managers and and others. The features of merit claimed by the company for its carbonized roofing are water, vermin and fireproof qualities, absence of effect upon the taste or character of rain-water; it is not affected by changes in temperature, hot gases, salt or acid fumes, and will not crack or become brittle with age. A point in favor of this peculiar product is that it is sold by measure and not by weight. The Jowitt Company has issued a neat catalogue containing full particulars concerning carbonized felt and roofing which will be of interest to those building new stations or contemplating the re-covering of old ones.

OTTO GOETZ, 15 Whitehall Street, New York, sole United States agent for a compound known as Mannocitin, which is manufactured by Edmund Müller & Mann, Charlottenberg, Germany, is distributing voluminous lists of testimonials from users of the compound. Mannocitin is a composition of grease and oils, and its function is the prevention of rust. It is applied like paint, and within a few hours after application the oils evaporate, leaving a thin, slightly soft film which adheres to the metal and is claimed to absolutely protect it against all influences of the atmosphere, salt and fresh water, and against the vapors of ammonia and muriatic acid. Mannocitin, the manufacturers state, contains no acid, does not turn rancid, leaves no spots or marks, but preserves the original polish of the metal. Mr. Goetz is also introducing Müller & Mann's rust-proof paints, which are somewhat similar to Mannocitin, but are more like regular roof paints. These are furnished in various colors, and differ from lead paints in that they dry very slowly, and are guaranteed to withstand concentrated hydrochloric acid fumes.

Record of Electric Railway Patents.

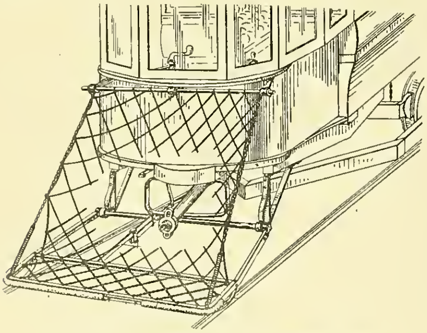
UNITED STATES PATENTS ISSUED DEC. 3, 1895.

550,615. CAR FENDER; Harry M. Hill, St. Louis, Mo. Filed April 2, 1895. The combination in a car fender of a frame having two rails converging to a point at the front, a bar pivoted to the forward ends of the frame, a guard fulcrumed on the bars, said guard being movable in a forward, backward and upward direction, a spring for returning the guard to its normal position on the bar after having been moved upwardly or backwardly, and a spring for returning the guard to its normal position after having been moved forwardly.



NO. 550,683.—TROLLEY WIRE CROSSING.

550,627. CAR BRAKE; Eugene E. La Rose, Providence, R. I. Filed March 27, 1895. In a railway car a suitably mounted car axle, track wheels secured thereon, brake shoes capable of being forced into frictional engagement with said wheels, levers and suitable connections substantially as usual arranged to be made operative by manual power in combination with a cone-shaped friction clutch having one member thereof positively driven by the said car axle, a suitably mounted slidable member arranged to frictionally engage with said driven clutch member, thus forming a power brake, connected with some suitable part of the said manual power-brake mechanism, and means consisting of a suitably mounted, quick-acting screw and its nut, and flexible connections uniting said screw with a suitable arm or lever capable of being actuated and controlled by the brakeman for forcing said slidable member into engagement with its fellow member.

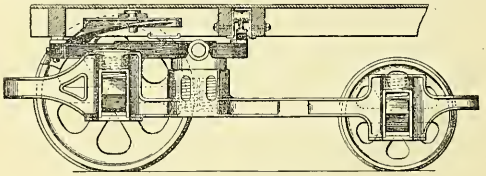


NO 550,684.—FENDER FOR STREET CARS.

550,683. TROLLEY WIRE CROSSING; John C. Kinney, San Antonio, Tex. Filed April 17, 1895. In a trolley crossing separate triangular-shaped brackets or arms belted to an insulating block or core, with a round-ended cone at bottom part, of the same size as the trolley wire, and having two independent bolt holes for bolting the brackets or arms in pairs, insulated from each other, to the insulating block or core, thus giving a continuous current without interfering with the cross line. (See Illustration.)

550,684. FENDER FOR STREET CARS; Duncan S. Macorquodale, Toronto, Can. Filed March 8, 1895. The combination with the fender hinged at the rear, beneath the dashboard, and the side-supporting chains attached to the bar on the top of the dashboard and connected by the lower spiral springs to the front bar of the fender, of the brake rod and means for connecting the fender to the brake rod so that by the turning of such rod the fender may be raised or lowered. (See Illustration.)

550,757. CAR TRUCK; Peter M. Kling, St. Louis, Mo. Filed April 8, 1895. The combination of a truck-frame, a body supporting frame mounted on the truck-frame, a bracket secured to the body-supporting frame, a pivotal connection between said bracket and car body, and a bearing between the car body and the inner end of the car body supporting frame; said bearing being formed by a segment pivoted to the car body and adapted to bear against the inner bar of said supporting frame. (See Illustration.)



NO. 550,757.—CAR TRUCK.

550,835. RAILWAY CAR; James F. Munsie, Brooklyn, N. Y., assignor to the Munsie-Coles Electric Railway Equipment Company, of New Jersey. Filed April 1, 1891. A railway car provided with trucks at its ends, and a main body portion suspended between the trucks, the trucks having pivotal connection with the car at points beyond the ends of the same, and the car body being cut away to permit the rear wheels of the truck to turn thereunder, said trucks carrying two axles, one shorter than the other, the shorter axle having a flanged wheel at each end and the longer axle having a flangeless wheel at each end.

550,928. CAR FENDER; Albert C. Woodworth, Providence, R. I. Filed Dec. 6, 1894. The combination with the dasher and hooks secured thereto, of a cushion device consisting of curved strips having their lower ends bent into the plane of the chord of their circle and their upper ends bent at angles beyond said plane, a bar secured to the lower ends, a bar secured to the upper vertical ends of said curved strips and adapted to be engaged and supported by the hooks, a bracing bar secured to the central curved portions of the strips and cross strips connecting the ends of the bars and forming spring chords.

550,935. CAR TRUCK; Gotheb A. Aenchbacher, Atlanta, Ga., assignor to Aenchbacher & Pince, same place. Filed Sept. 1, 1894. In combination the cheek pieces or hangers, supporting the beam of the car having vertical guide flanges or edges, a bridge composed of the upper and lower bars and end blocks, said end blocks being fitted to slide on the guiding flanges or edges of the cheek pieces, an axle box having guiding connections with the said upper and lower bars and arranged to move thereon, springs interposed between said axle-box and said end pieces, said springs being supported on the box and end pieces, and vertically arranged springs interposed between the end block and the car, with guide rods therefor extending through said pieces.

Electric Railway Gazette.

Vol. XIII. NEW YORK, DECEMBER 21, 1895. No. 25.

The Newark Power Station of the Consolidated Traction Company.

A short description of the main power plant of the Consolidated Traction Company, of New Jersey, was published in the ELECTRIC RAILWAY GAZETTE of April 6. At that time the plant was in course of construction, and a very small part of the proposed equipment was installed. Although still incomplete, this plant now presents many interesting engineering features. The company operates one of the most extensive electric railway systems in the country, and owns upward of 160 miles of double track in Jersey City, Newark, Orange and Elizabeth. The main power plant, which is located on the Passaic River between Stiles and Coles Streets, occupies a plot of ground 160 by 190 feet. The building is of brick, with stone trimmings, and is one story in height, with a monitor roof supported by iron trusses; the roof is constructed of Georgia pine, upon which is laid a layer of white pine, and this is covered by asbestos and felt, which in turn is given a coating of tar and gravel. The foundations are of concrete supported by piling.

The engine-room is located in the river side of the building, and measures 96 by 150 feet. The present power equipment consists of one cross-compound Reynolds Corliss engine, of 750 horse-power, manufactured by the E. P. Allis Company, with cylinders of 76 and 32 inches, respectively, diameter and 42 inches stroke, and three Watts-Campbell cross-compound Corliss engines of 1500 horse-power each. Each of the Watts-Campbell engines is direct-connected to a Westinghouse multipolar generator of 800 kilowatts capacity, and the Reynolds-Corliss engine is connected to a 500-kw generator of the same type. The plant will shortly be increased by the addition of two cross-compound Allis engines which will be direct-connected to General Electric generators of 1500 kilowatts capacity each.

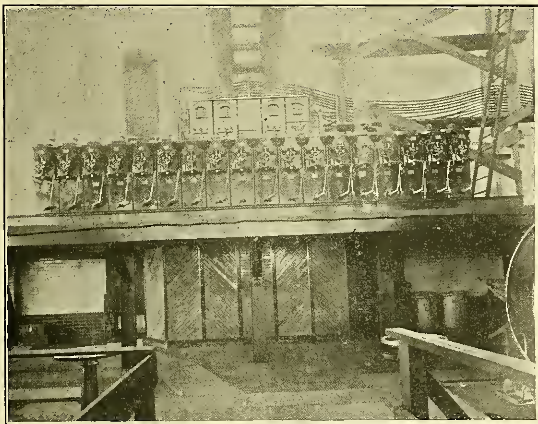


FIG. 1.—CIRCUIT-BREAKERS,

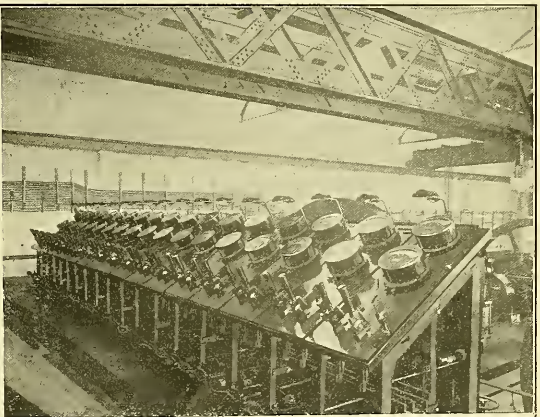


FIG. 2.—FEEDER PANELS.

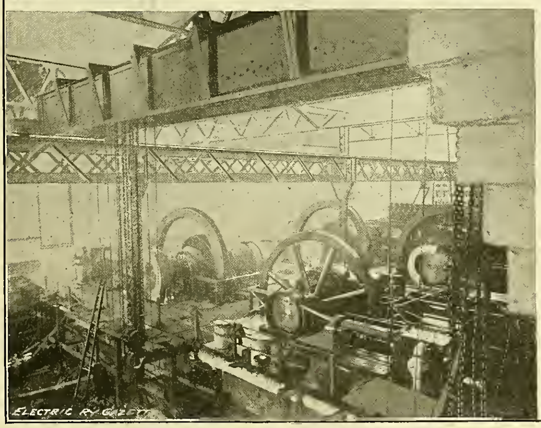


FIG. 3.—ENGINE ROOM.

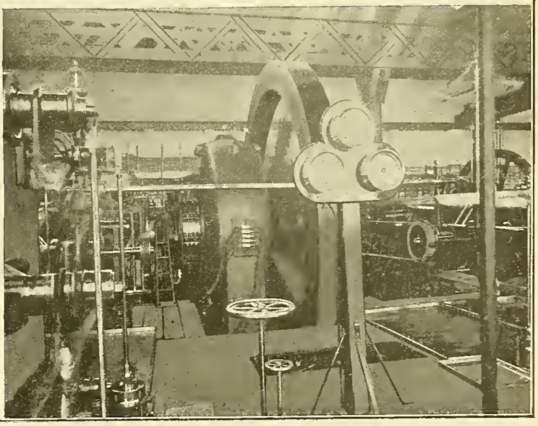


FIG. 4.—WESTINGHOUSE GENERATOR.

The switchboard is of the "pulpit" type, similar to that on the Eastern power station of the Brooklyn City Railway. The platform which sustains the switchboard is conveniently located in the centre of the southern end of the engine room, and is elevated about eight feet above the floor. The dimensions of the platform are about 14 feet in width by 35 feet in length. The switchboard is divided into panels, in accordance with the latest engineering practice. The machine panels are all of marble and are located at the back of the platform. At the present time there are four machine panels, one for each dynamo, and one panel located in the centre, equipped with a station voltmeter and a Thomson recording wattmeter. Each of the generator panels is provided with an ammeter, an automatic circuit-breaker, positive and negative switches and a rheostat.

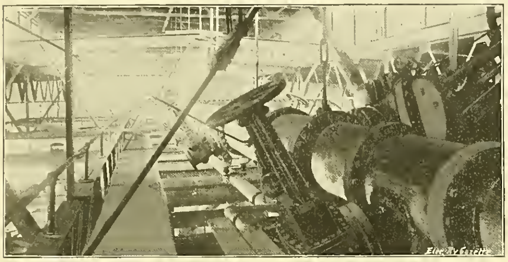


FIG. 5.—LARGE STEAM CONNECTIONS.

The positive and negative switches are located side by side, so that one operator can control the throwing in or out of any generator. When the two additional 1500-kw units are installed, two switchboard panels of black marbleized slate will be added, one to be located on each side of the present switchboard. The top, sides and intersectors of the panels will be trimmed with brass, and when completed it will present an exceedingly handsome appearance.

The feeder panels are located at the front of the platform. The arrangement is practically the same as that employed in the Eastern station of the Brooklyn City Railway, already referred to. There are 18 panels of marbleized slate, which are supported by an iron frame. Each panel contains two Weston ammeters and two switches. The circuit-breakers are attached to the marbleized panels located on the front of the "pulpit," a sshown in Fig. 1. The instruments on the machine board are of the Westinghouse type. All the wiring, as well as the piping, is carried under the floor.

The engine-room is provided with two traveling cranes of 20 tons capacity each. An abundance of light and ventilation is furnished by large windows on three sides and by windows extending the entire length of the monitor roof. A dodo of enameled brick extends around the base of the walls, and when completed the station will present a very attractive appearance.

The boiler-room measures 113 feet 4 inches by 88 feet 10 inches, and contains 16 Babcock & Wilcox boilers arranged in eight batteries of two each, each battery having a capacity of 500 horse-power. The floor is constructed of brick, covered with eight inches of Portland cement. The boilers are furnished with Butman rocking grates, and hoppers are provided, from which the ashes are dumped directly into iron ash cars running on tracks in the basement.

Independent jet condensers are employed, and the condensing and boiler feed-water is obtained from the Passaic River, that for the boilers being pumped from the river into storage tanks of about 200,000 gallons aggregate capacity. The water is filtered before it is used.

Each battery of boilers is connected, by means of two 8-inch pipes, with a 20-inch main extending through the centre of the room. Steam is taken from this main by two 20-inch pipes and passes through two large separators before entering the engine-room. From the separators the steam passes to a main extending through the centre of the room between the engines. Branch pipes lead from the main to separators or reservoirs located directly under each engine.

Provision has been made in the arrangement of the valves and piping so that in case of accident to the high-pressure cylinder steam can be taken through a reducing valve directly into the low-pressure cylinder. The stack is one of the handsomest of its kind. It is constructed of steel with a brick lining and stands 225 feet above the foundation ; the brick lining ranges from 13½ inches in thickness at the bottom to 4½ at the top. The base is 30 feet in height and tapers from 18 feet in diameter at the bottom to 12 feet at the top.

Green economizers are employed, and the flues are so arranged that they may be cut out by means of dampers operated by hand wheels in the oil room above the economizers.

The location of the station affords excellent facilities for receiving coal, which may be brought directly to the station by railway or boat. Two large coal pockets of 3000 tons capacity are located over the water tanks, and a complete system of coal handling apparatus is provided for delivering the coal to hoppers directly in front of the boilers.

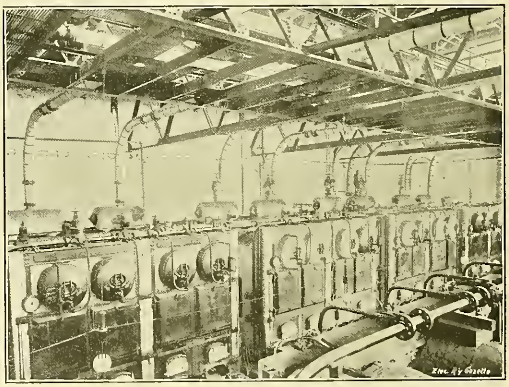


FIG. 6.—THE BOILER PLANT.

The plant will be equipped with a complete oiling system. From tanks in the oil-room referred to above, the oil will flow by gravity to all the bearings, and the drip will pass to filters in the basement and will be pumped thence back to the reservoir in the oil-room.

This plant when complete will probably operate all the lines in Newark, including the Newark & New York line as far as the Hackensack River.

A 1500-KW Generator.

So greatly has the traffic of the West End Street Railway Company of Boston increased, that the company is finding it necessary to use every available machine, even to those of the old bipolar plant, and although two massive generators of 1300 kw capacity were recently installed, it has been found advisable to add another generating set, capable of furnishing 2500 amperes at 600 volts and normally rated at 1500 kilowatts. As such units are always rated low, there is but little doubt that this machine could carry for several hours a load of upward of 3000 amperes without serious heating. Be that as it may, the substantial construction of the generator cannot fail to command universal admiration.

The armature core of this generator is built directly on the shaft of an Allis cross-compound engine; the shaft is two feet in diameter, and weighs something over 60 tons. The armature core is receiving its windings while in position on the shaft. The core is built up of nine lammelar sections separated by eight brass spiders, leaving ventilating apertures at those points; each section contains about 210 sheets of soft charcoal iron. The core is provided with 696 slots, each of which contains two copper conductors insulated from the slot and from each other. The conductors are firmly locked in the slot by driving in a long wooden wedge above them, and the slots are liberally lined with fuller board and mica before the insertion of the bars, which are individually insulated with tape and mica. A section of a slot is shown in Fig. 1.

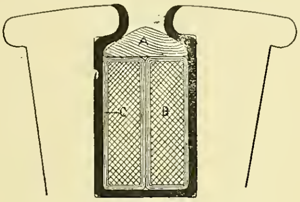


FIG. 1.—A SLOT SECTION.

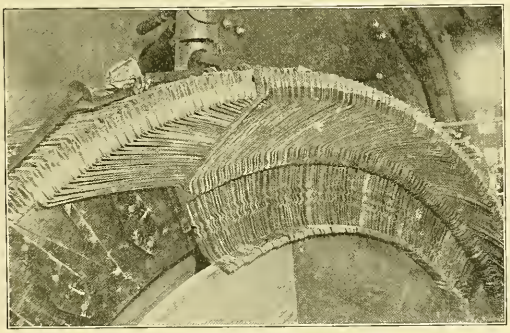


FIG. 2.—CONNECTOR SYSTEM.

The spiral method of connection is used on this machine, as shown in Fig. 2. The bars are usually inserted carrying the front connector already soldered on, and the rear connector is attached after the bar has been locked in position. The machine has twelve poles and therefore the connectors partake very little of the spiral form, being only slightly curved. The rectangular copper bars are ¼ inch by ¾ inch, and are fastened to the connectors by a copper clamp, the joint being afterward sweated with solder. The peculiar shape of the armature tooth renders it next to impossible to dislodge a conductor either by magnetic drag or centrifugal force. Two weeks are needed in which to wind the armature, one of which is required for preparing and insulating the grooves. The speed of the dynamo is but 75 revolutions per minute.

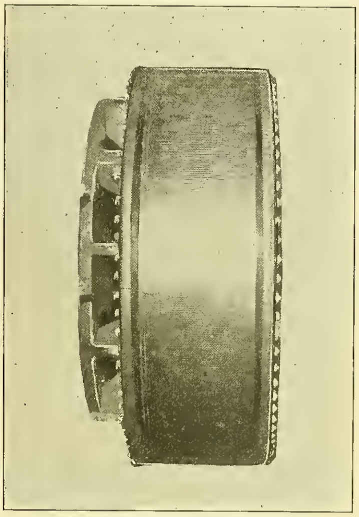


FIG. 3—THE COMMUTATOR.

The diameter of the armature is 10 feet 6 inches, and its weight, with commutator, approximately 40 tons The commutator, which is shown by Fig. 3, is a splendid piece of work, 20 inches across the face and 7 feet in diameter. The clearance of the armature will be about ¼ inch. The armature is multiple-wound, and twelve sets of brushes are to be employed. The field magnet is to be of cast steel.

A general view of the set is shown in Fig. 4; it is interesting from a mechanical as well as an electrical point of view. The Allis cross-compound engine takes steam at 180 pounds, and expands in two cylinders 32 and 62 inches in diameter respectively. The stroke is 60 inches. The 73-ton fly-wheel is 24 feet in diameter and has a circumferential speed of 5655 feet per minute. It is, however, substantially built to withstand this stress, being made up of 19 1-inch wrought-iron plates. The second

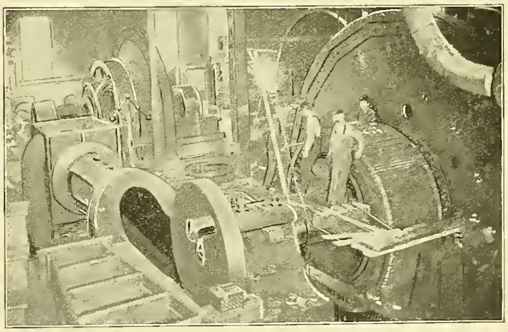


FIG. 4—VIEW OF COMMUTATOR END OF ARMATURE.

and the eighteenth plates form webs going clear to the hub. The wheel is fastened together with 128 1¾-inch iron rivets and is composed of 69 web sections.

Union Traction Employees Strike.

Since the formation of the Union Traction Company, of Philadelphia, by the amalgamation of the People's, Philadelphia and Electric Traction companies, a number of changes have been made with respect to the employees, which caused universal dissatisfaction among them. This culminated in a general strike on last Tuesday, which is still on, and bids fair to rival the memorable affair in Brooklyn.

The Amalgamated Association of Street Railway Employees on Monday sent a communication to President Welsh setting forth the grievances of the men and making the following demands:

First—That 10 consecutive hours shall constitute a day's work, for which $2 shall be paid.

Second—That due consideration shall be manifested for the comfort of the motormen.

Third—That sweepers, snow-ploughs and trippers shall be considered special work, for which extra compensation shall be paid.

Fourth—That no employee shall be discharged for belonging to any particular organization, and that all men dismissed for their alleged affiliation with the Amalgamated Association shall be immediately reinstated.

These conditions were sent to President Welsh, of the Union Traction Company, after he had declined to treat with the representatives of the Amalgamated Association, and the failure of the Traction Company to entertain the demands resulted in the ordering out of the men by the Association. The strike went into effect on Tuesday morning, and the first attempt made by the Company to run a car over each of the forty-five branches was not wholly successful. For four or five hours before the beginning of the trouble crowds were gathering around the various stables of the railroad companies, hooting at the few men who wanted to go to work and who ran the cars out of the stables. Occasionally a brick or a stone was thrown, but there was nothing at all serious, and the police did not interfere, and did not make any effort to disperse the crowds. Later on the strikers became so riotous that the police were utterly incapable of preventing disorder, and wherever there was an outbreak the rioters had everything their own way. This was probably fortunate, for with no opposition they contented themselves with smashing cars, destroying railroad property, piling obstacles on the tracks in the chief streets of the city, and occasionally beating a policeman or a non-union workman, whichever happened to be the handiest.

Shortly after 1 o'clock a mob formed on Chestnut Street, near Eighth Street, and rushed up the street. The first car they met they stopped, dragged the motorman and conductor from the platform, and made a wreck of the car. The car itself was pushed from the track. The car behind the wrecked one was, of course, at a standstill. The motorman and conductor deserted, and the host of holiday shoppers promptly followed suit. This car was smashed in and the mob rushed up to where a line of cars was halted between Ninth and Tenth Streets; these were attacked, and in less than ten minutes there was a long line of battered and disabled cars extending from Eighth Street to above Tenth.

The Mayor, after standing on a corner and watching half a dozen cars demolished in Chestnut Street, issued the following proclamation:

> In view of the pending strike of the employees of the passenger railway companies of this city, I deem it my duty to call upon all good citizens to assist the authorities in preserving the public peace, and to this end it is especially desirable that they should refrain from gathering in crowds upon the public highways. Violence and riot will be met with force, and violators of the law will be dealt with rigorously. The peace of the city must be preserved at all hazards. Charles F. Warwick, *Mayor*.

Several mail cars were carried through and were generally unmolested, but there were nevertheless sufficiently frequent delays, due to obstructions on the tracks, to cause the postal authorities to have a United States Marshal accompany each mail car.

There was considerable improvement in the situation on Wednesday, though there were occasional outbreaks of mob violence during the day in different parts of the city. The company ran cars, under the protection of the police, on nearly every line of its system. The trips were made at infrequent intervals, and the cars were blocked often by obstructions on the track or the interference of disorderly mobs. Tuesday's rioting and the assaults made upon the motormen and conductors who took out cars, intimidated a large number of men who were willing to stick to the company, and while not counted among the strikers, they were afraid to man the cars.

On Wednesday the greatest disorder of the day occurred during the afternoon on Market Street, where mobs followed a car from Broad Street to Delaware Avenue, demolishing the windows and creating a riot, that the police only quelled after repeated charges. There was also much disturbance in the vicinity of the City Hall.

On Thursday some degree of order had been restored, although there was still displayed a riotous spirit in certain quarters which required force to subdue. The Traction Company succeeded in operating more cars than had been run on previous days and with smaller guards, but no attempt was made to fully operate any of the lines. Violence broke out in Western Philadelphia on Thursday night, when a motorman employed on the Lancaster Avenue branch was assaulted by strikers because he refused to join their ranks and insisted upon his right to continue work. Notwithstanding the oft-repeated assertions of the strikers that the company cannot secure enough men to handle the cars, applications for positions as motormen and conductors are constantly being received. Hundreds of men have expressed their willingness to run the cars if they can be afforded protection.

It is estimated that the loss to the motormen and conductors of the company in wages by reason of the strike was $9,000 to $10,000 for each day, or nearly $30,000 for the first three days of the strike. The loss to the company in receipts is said to have been $25,000 to $30,000. An estimate of the damage to cars and property by the mob is $10,000, which the city will have to pay.

English Views of Electric Traction.

In reading a paper on "Electric Locomotives" before the Manchester Association of Engineers, Mr. Edgar Worthington referred to the fact that he had had something to do with the engines of the South London Railway, and had studied electric railways in many countries. Mr. Worthington's chief experience has been in steam locomotives, and it is satisfactory to find one of so conservative a class of men so open-minded as this paper clearly shows our author to be. Reviewing the history of electrical traction, it is stated that the first commercially successful electric railway only dates from 1886, when there were only some 12 or 13 lines in the whole world. Boston (U. S.) did not possess a line until 1889, yet in 1893 could drive 640 cars from one central station, and Americans had been the boldest experimenters in electric traction. Historically, the earliest electric locomotive was made by a village blacksmith in 1835, and did not differ materially from present-day types. One of them was even brought to England and seen by Faraday, who, however, refused his recommendation because he was able to stop it easily with a broom. When the author visited America in 1881-3, only one electric line of any moment was in existence—that at Richmond, on the Sprague system, but it ended in failure. Since then the great growth of lines has been chiefly on the overhead trolley system, and in 1893 there were 13,000 miles of electric railway in the United States, and only some 440 miles in Europe. The largest of the European lines are the South London, using 1200 kilowatts, and the Liverpool overhead line, using 900 kilowatts. In the United States a daily car mileage per car of 150 to 200 is sometimes reached. The Leeds Tramway car mileage per car sometimes reaches 110 per day, while the cars of the Halle Tramway, one of the best equipped in Germany, run only 71 miles a day.

It is stated that financial experience shows that electricity is not likely to supplant the cable for crowded traffic, or the steam motor for infrequent service, but that its special traffic is that of moderate dimensions. As regards power of acceleration, this is not wanting in modern electric motors. At San Francisco, where coal is lifted 60 or 80 feet by electric cranes, it is hauled away by locomotives with a drawbar pull of 800 pounds, and the load variation on the dynamo rises from 0 to 75 per cent. of full load in 5 to 10 seconds, and again drops in the same time. Summarizing the advantages and facilities of electricity in town and suburban traffic, these are given as follows: Comfort, speed, cleanliness, lighting, heating, ventilating, and, perhaps soon to follow, an electric brake, which will give back 40 per cent. of the energy it absorbs.

From a mechanical standpoint, a railway motor must have a large torque, to be obtained by a large number of windings in the armature, whereby, also, are diminished hysteresis and eddy currents, and an absence of sparking and heating. Mr. Parshall has said that heavy magnetic induction is aimed at, there being:

100,000 C. G. S. lines of force per square inch of yoke.
60,000 " " " " " air space.
80,000 " " " " " armature core.

A motor ought to be economical when lightly loaded, for their average work is but 20 per cent. of their maximum starting duty. The gearing of an American tram motor has, says Kennedy, an efficiency of 75 per cent., the difference between a geared and ungeared motor being 17 per cent. Other authorities give 80 per cent. efficiency in good single-reduction motors, and the Westinghouse Company profess an efficiency of 92-96 per cent. under full load. In double-geared motors, as between armature and axle, 60 per cent. was rarely to be obtained. Motors are series-wound, and have carbon brushes. The spur-wheel gearing is milled out of the solid, and the whole motor is cased in a box close enough to allow a car to run through water, which the author has seen nearly up to the axles.

As regards the requirements of a motor, there should be lightness, tightness to water or dirt, accessibility, a power to run two hours at nominal rating, without heating above 122° F., and a capacity of developing an excess of 50 per cent. above rating on an emergency. A modern motor of 20 horse-power weighs 800 pounds, with its single-reduction gear. The direct motors of the Liverpool line weigh 52 cwts.; the new large motors of the Baltimore Tunnel weigh over 11 tons, entirely supported by springs. In the Heilmann engine the motor weighs 2.7 tons, and is carried on the frames. Lightness is essential, and in all cases the armature and magnets must move together, if the armature is to maintain uniform clearance.

Referring to starting power, Mr. Worthington expresses his doubts as to American figures. He thinks that the Chicago tests of street motors in 1893 were useless, the competitors sanding the rails and using other devices to obtain grip while registering a maximum tractive force by dynamometer, secured by what he looks on as tricky manipulation of the current.

The 95-ton Baltimore engine is rated at 1800 horsepower, but he doubts the daily practice, and states that the traffic is being worked *slowly* to-day by these engines. Regulation is effected by a barrel switch, the barrel carrying metallic strips as arcs on its surface, and sparks being "blown out," as they tend to form, by an embracing magnet. In a pair of 30-ph Westinghouse motors, this barrel switch has seven positions, as follows:

1. Starting with 500-volt current passing through both motors, all in series.
2. As in 1, with half the resistance cut out.
3. As in 1, with all resistance cut out.
4. With reduced magnetic field.
5. One motor cut out.
6. Both motors, but run in parallel without resistance.
7. As 6, with reduced field.

The resistances are spiral rolls of tape iron, mica insulated, and they often get red hot. There is a separate reversing switch.

As regards the work of the machinist to be put on an electric engine, there is little need of this. Having no reciprocation, there is little need of careful fitting, and no tendency to knock at the axle-box guides, etc. The picking up of current is next discussed, and the inconveniences arising from want of a return wire. For fenced-in lines, the third rail, as at Liverpool, or in the City line, is obviously the proper thing. Conduits have their many well-known disadvantages of dirt and wet, unless closed, and contact assured on the surface by means of magnets, which raise the conductor against the sections of surface strip. Schuckert found heaps of iron filings to make contact more surely and easily, and Edison is said to be developing a system in which a current of 1000 volts will be transformed at intervals into 20-volt currents in sections of the rail itself. At this point Mr. Worthington delivers judgment upon the "unsightly posts and overhead wires of American cities, which it would be a blessing to remove." It almost looks as though he took his ideas of the overhead system entirely from some of the cruder installations of America, and had given no heed to their better lines, or to our own lines, such as Bristol. As regards fire escapes, we might again ask: Is it necessary that these should be run vertically through the streets?

Four types of electrical locomotives are named, to wit, those with storage batteries; with gearing and picked-up current, and the same direct-driven, and *mirabile dictu!!* the Heilmann!! We should scarcely have thought that an engineer of Mr. Worthington's experience would have cared to class the Heilmann engine at all. However, he does so, and even gives his hearers to understand that it has been worked successfully on several main lines of French railways, to which statement we would like to ask when, and where, for he says it has run regular trains at high speeds? To us this traveling central station seems the height of absurdity. Granting all that can be claimed for the use of highly economical engines, it will take a good deal of economy to make up for the complication, expense and inconvenience of the system, in face of the fine results obtained with ordinary or compound steam locomotives, while for the very class of high-speed traffic specially claimed for the Heilmann engine, the ordinary locomotive with its then high-rotative speed cannot be surpassed.

We would merely note that while the engine weighs 120 tons, it drew a train of 63 tons at an average speed of 43.75 miles per hour for 50 minutes.

Storage-battery locomotives have had a limited application in New York and Paris, and have run 23 miles on one charge in tramway work, the batteries giving up 70 per cent. of their charged energy. A French railway company, the Paris & Lyons, built in 1893 an accumulator-driven engine of 246 hp, carrying batteries itself, and hauling also a further supply in a tender of 44 tons' weight, but this railway has now abandoned its experiments. Altogether, we should say that no very great showing has been yet made in accumulator work.

In geared motors with underground conductors the 10 years' success of the Blackpool line is notable. We well remember our ride on the first of Mr. Holroyd Smith's lines, a few yards in length, laid in a Halifax garden.

Gearing by pitch chains has not been a success, though it affords the advantage of removing the motor weight from off the axle, but the chain gets dirty and dusty. Coupling rods have been tried for the same purpose, but these, again, introduce the objectionable reciprocating stresses and the necessity of engine fitting, and coupling rods have thus not come into favor. Worm gearing has been tried, but though it allows of a small motor doing a heavy duty, it is only used for small speeds. We remember, however, that worm gearing ran exceedingly well on the steam tramway engines of Wilkinson, in Wigan, and they certainly could not have been large producers of friction, because in running down hill the worm wheel on the axle actually drove the worm, and of course the engines themselves, easily and smoothly. Wilkinson's worm and gear were very nicely made, and we well remember that he had every faith in the appliance, and he was undoubtedly a very able mechanical engineer. Double spur-gearing has been used for the same end in freight work, but, except for slow-moving machines, it is unsuited by reason of jar and teeth breakage.

Various engines have been made with double-reduction motors, some with the gears in an oil-tight case, but by far the larger number of electric street motors are of the single reduction, 4 or 4½ to 1 gearing, the teeth being all cut from solid blanks.

In one day in October, 1893, 11,271 car miles were run by Chicago cars on 26 miles of line, and 208,575 passengers were carried. The average voltage the day through was 540 for 20 hours, the flow was 1050 amperes, and the maximum was 17,000, the coal consumed being 23 tons. This works out at about 4 ounces of coal per passenger. Of English-built lines on the system are that at Leeds, Dublin, Bristol, and Hobart Town.

Of direct-driven motors, one of the earliest and most successful is to be seen on the South London line, where two axle engines of 10⅓ tons carry on each axle half a ton of field magnet, dead weight, in addition to the armature. One end of the field magnet is carried on a girder across the frames. The power is 50 horse-power, at a speed of 25 miles, and the current varies between 50 and 100 amperes, occasionally reaching 150, with a maximum tractive starting effort of one ton or more.

In the Nantasket Beach line the voltage is 700; the biggest engine has a motor of 100 horse-power on each of axles, and a drawbar pull of 8000 lbs.; but the largest four American locomotive is that at Baltimore, before referred to, and designed to haul a train through tunnels on the Baltimore Belt line for sake of ventilation, which, however, is a little spoiled by the present practice of hauling smoking locomotives also through the tunnels. So far, these electric locomotives are not credited with any brilliant success, but it should be noted that the mishap with the picking-up shoe was rather due to mechanical defects, and can scarcely be urged against the system. The Baltimore engine will overpower a steam locomotive of equal adhesion, owing to its regular torque; but this, of course, is not a matter of very great moment, and of no moment at all when speed has been attained. Schemes—merely promulgated, and never carried to fruition—are briefly noted, and need not be further referred to by us.

As regards cost of electric lines, the experience of America is to the effect that the initial cost of power-house generators, car-shed motors and accessories, runs to £1000 per motor car, and permanent way complete, except for paving, to £2000 per mile of single track. Including paving, the permanent way alone, without pole line, will cost 4393 per mile of single, and £9440 per mile for double line, with 78 pounds step rail.

Expenses of running are apt to decrease with age. On the South London line they fell from 8.4d. per train mile to 5.31d. in 1893, by which time the cost per B.O.T. unit was 1.56d., including office expenses. An American estimate of operating cost of six miles of double line per 16-hour day is 7d. per train mile, and generally an electric and a cable line have about equal operating expenses. As an illustration of three types there are given the City of London electric line at 5.31d., the Frankfort horse line at 8.02d., and the Birmingham steam trams at

7.31d., while the Halle electric line, at a fare of 1½d., has a working cost of 59 per cent. of receipts, and pays 5.1 per cent. dividend. In Boston a car-mile rate of cost of 1s., as with horsecars, has been reduced in populous districts to 6d., and even 4d. Summing up, we are glad to say that the paper is favorable to the future of electric traction, and we think the author is right in emphasizing its sphere as that of the light suburban passenger traffic. Indeed, so far, we are not disposed to quarrel with him in showing up the doubtful status of what we would term the more ambitious schemes. We are no believers in the early death of steam traction, but we do strongly believe in electric traction in its own peculiar sphere, and the author of this paper seems to be very much of the same mind, for he considers it would be wise of the railway companies to develop electrical traction on feeder lines in thickly populated districts, or otherwise they will find themselves face to face with competing electrical lines that will deprive them of much traffic. As a whole, the paper is very good, but not an easy one to abstract.

It is a very fair historical statement of the electric traction movement, which has attained so great a growth in the few years of its life. At the same time, in its figures of American progress it affords great hope of what we may expect when the antipathy to overhead systems has been overcome by a few more cases like Bristol. When such a growth of electrical traction does come upon us it should not prove an unmixed blessing that there has been so much delay. England has constructed her steam railways much as America has built her electric lines, and the result has been in many respects far from advantageous, because of the limits set upon extension by the primitive construction suited to the earlier rolling stock. America had the benefit of a fuller experience at our expense, and it looks as though a sort of reciprocity were now about to be set up.

We may look on the paper as some indication of the attitude of the more liberal type of steam locomotive men toward the newer form of traction. The Manchester firm of Beyer, Peacock & Co., has, in a sense, paralelled that of the Baldwin Company, of Philadelphia. The latter firm has joined with the Westinghouse Electrical Company in forwarding, to some extent, the interests of electrical traction, and Messrs. Beyer & Peacock have done somewhat similarly on this side, and will doubtless reap considerable benefit in due season from their forward step.—London *Electrical Review.*

Street Railway Engineers.—XXX.

J. H. VAIL.

Mr. J. H. Vail is well known throughout electrical circles by reason of his having for many years been actively identified with the Edison electric interests as chief engineer. His experience in electric traction work dates back to 1887. Mr. Vail was born in Middlesex County, N. J. After finishing his education, his natural inclination for mechanics led him to enter the Empire Machine Works at New Brunswick, N. J., where he spent nearly seven years. Rising rapidly in his chosen profession, he was appointed superintendent of the works after two years' service, and soon became manager.

In the Summer of 1880, Mr. Vail entered the employ of Mr. Edison at Menlo Park, N. J. During the Fall and Winter of 1880 and 1888 he was in charge of the original exhibition central station plant at that place, thus obtaining an experience that can never be forgotten, and which not a few envy him. He erected the original exhibition plant at 65 Fifth Avenue in February, 1881, and installed many of the early isolated plants of the Edison Company. He was appointed superintendent in December, 1881, and later, chief engineer of the isolated lighting department of the Edison Company. In 1885 the Edison central station business was taken over by the Edison Isolated Company, and Mr. Vail became chief engineer of central station construction. Nearly 200 central stations have been constructed under his supervision.

J H. VAIL.

Mr. Vail was early identified with the Sprague Electric Railway & Motor Company as consulting engineer, and for the last two years of that company's existence was its chief engineer. The valuable practical experience already gained in the electric light field he applied with beneficial results to electric railway construction.

Mr. Vail is now engaged in supervising and consulting work, in which line he has been identified with a large amount of successful electric railway work, and many large generating stations. He possesses in an unusual degree the valuable faculty of analyzing the merits of new devices, apparatus or systems, and the ability to combine in a station or system such apparatus as will show best results. Mr. Vail's experience in steam plant construction covers an aggregate of 45,000 horsepower, and he has done much important work with compound-condensing and triple-expansion condensing engines. He is a member of the American Society of Mechanical Engineers, and the American Institute of Electrical Engineers.

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CABLE VS. ELECTRIC TRACTION.

The practical working of the cable road, uneconomical as it may be, cannot be denied, and many miles of this construction are being successfully operated in various parts of the country. It should at once occur to those familiar in any degree with cable traction that precisely the same obstacles are present as with electric conduit working. Water in the conduit is even more objectionable, for not only does it tie up the road, but any attempt to run with a wet cable means its failure in a few hours. Therefore, a section of flooded conduit may tie up a much longer line on a cable road than on an underground electric system. If it is feasible to use a mechanically live cable in a conduit system it is certainly possible to operate a mechanically dead wire. Of the two methods of propulsion, failure would have been predicted for the cable road rather than the electric. Therefore, these comparisons conclusively point to the fact that an underground trolley system can be successfully operated wherever a cable system has proved a success, as far as Winter weather is concerned.

ONE THOUSAND MILES AN HOUR.

A certain New York inventor has suggested certain principles by which the fabulous rate of speed of 1000 miles an hour can be safely attained. Not only that, but Thomas A. Edison has declared his principles perfectly sound, and has prophesied limitless results. The system consists of a roadbed which forms a closed loop and carries a sidewalk moving at the highest possible speed. On top of this, and moving in the same direction, is another platform, also moving as fast as convenient, and so on indefinitely. The top platform will have the speed of all these, plus its own. The details of the scheme are jealously guarded. It is never safe for a technical paper to destructively criticise any scheme when it is first proposed, for the fallibility of editorial judgment has led to many embarrassing situations in the annals of scientific journalism. But, however that may be, it is certainly true that correct principle is one thing and commercial feasibility is another, and oftentimes a wide gap separates the two. The details of this scheme, so carefully reserved, must indeed be startling, so much so that the principle itself, even if it has aroused the admiration of Mr. Edison, will sink into insignificance. Let us, therefore, patiently await the coming of these indispensable details. Their general, as well as special, significance and application cannot fail to awake a widespread interest.

THE TRUCK FACTOR IN ELECTRIC RAILWAY ECONOMY.

Where is the energy supplied to a street railway motor used? It is perfectly obvious that, with the exception of air resistance, all of the energy which is so economically delivered to the motor pinion is eventually consumed by the truck. Yet what do railway managers consider when buying trucks? First, a strong truck; second, an easy riding one; third, a low-built one, and last, but by no means least, a cheap one. Some deeper thinkers buy light and easy-running trucks. By careful truck design large savings of energy can be attained. The dynamo and motor waste but a small percentage of energy, but the truck and brake shoe consume all that they receive—often 80 per cent. of the total energy generated; the energy expended in attaining momentum and surmounting grades is eventually delivered to the truck and lost in heat. It would seem, therefore, that considerable economy can be attained by making the truck flexible, improving the bearings, reducing the weight. It is safe to say that the modern bicycle requires considerably less than half the energy to propel it than did the older forms, and the improvement is solely due to changes of the nature indicated. Setting aside cost as a secondary factor, a truck that would effect a saving of even 20 per cent. of the coal bill or increase the capacity of the road the same amount, would be cheap at double the present prices. But the best part of all this is that such a truck is perfectly feasible at such a figure.

RAILWAY GENERATOR DESIGN.

Elsewhere in this issue we print a description of a large railway generator which is now under construction, and which serves as an illustration of the substantial progress made in this branch of engineering within a very short period. The "outward and visible" advances perceptible to the lay public have been duly harped upon by those members of the daily press who have not indulged in the cheerful pastime of indiscriminately anathematizing everything and everybody connected with the industry; it is not the commercial but the technical progress to which we allude. Two years ago the market was filled with a heterogeneous agglomeration of railway generators. There were the Edison and inverted bipolar types; wholly iron-clad, bipolar and quadripolar types; the armatures had plain or special Gramme or Siemens windings, on the surface or in slots, as the fancy of each designer dictated, the ruling motive apparently being to produce a machine different from that of "the other fellow"—with demoralizing success. We know of one case in which an inferior machine was sold on the argument that its Gramme winding gave larger radiating surface than the excellent slot-wound drum armature of a competitor, and that this rendered a burn-out impossible! It was with uncharitable but human satisfaction that the competitor displaced the fireproof machine after a three months' run, one end of its armature having been reduced practically to cinders. This sort of occurrence has grown more and more infrequent until now American practice has become so uniform that the purchaser is not confused by a mass of conflicting claims concerning types, efficiencies, etc. The employment of toothed armature cores, independently insulated coils, and spiral end connectors is almost as universal as the use of copper for conductors; the same is true of the multipolar field magnet, with radial cores and circular outer frame, while the maker of any standard machine would be ashamed to have his product fall short more than 1 per cent. of the highest ruling efficiency for a given size of generator.

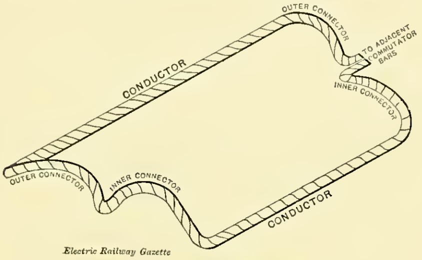
THE PHILADELPHIA STRIKE.

The present condition of the Philadelphia strike seems to be a repetition of history. It is the old story: A list of grievances, a refusal to adjust them, a strike and unwise use of violence; and inevitably a restoration of order even at the cost of human life. It is to be remarked that in this case the public sympathy is strongly in favor of the strikers, not only because of what is considered the reasonable nature of their demands, but also on account of an intense public hatred which the Union Traction Company has engendered by its previous policy. It cannot be other than universally admitted that street railway employees have their rights; but so have street railway companies. Both are organizations of great power, and with able leadership can do much to accomplish the ends that they desire. There is always a turbulent spirit that is ready at any time to manifest a sympathy which is undesirable, and always harmful to the cause of the strikers. Violence will never excite the class of sympathy that wins, and will be sure to destroy that which already exists.

In this strike, as in hundreds of others, the most active rioters are parties having no interest with the strikers, but are desirous of a season of pillage and plunder. Some of those arrested are mere boys. But few of the striking employees are taken into custody, and those because their presence in rioting crowds renders them suspicious characters. When a large body of men who have elected the best of their number as representatives themselves through these make demands upon their employers, their requests should at least be heeded, if on no other grounds than that the opinions of so many should receive consideration from all who desire to be fair. But when this same body of men commits, or encourages others to commit in their cause, acts of violence, they at once stultify themselves. The arm of the law will inevitably reach out and quell them. Thus the spirit of the strike will go on, and when those who are so firmly united have lost their enterprise and public sympathy, they will have no energy but to pursue the real and legal methods of redress which are open to them. A stampede for places begins and the strike is broken. Successful strikes are those in which the minimum of violence is employed.

Some New Types of Formers for Armature Coils.

The accepted method for winding all drum armatures for railway purposes is to form a coil out of wire, insulate it separately and lay the finished coil upon the armature. In order to separate the coils accurately and rapidly one or more forming devices are necessary. The object of this article is to describe a few simple forms that the writer has found very useful. One of the most familiar shapes is the well-known Eickemeyer coil, shown in Fig. 1. It is by no means an easy coil to form if it is to fit nicely. The form of such coils is frequently laid out by a rule-of-thumb method that makes the actual work very tedious and only partially successful. There is no reason why formers properly designed should not at once shape the coil so that it will readily and symmetrically pack in place. The Eickemeyer coil, as will be noticed, has two spiral connectors lying in different planes. It is not feasible to form the coil in one complete motion when it is made of stiff wire; coils made of soft, flexible wire are very simple as they may be wound upon a properly shaped wooden block, but the stiff wire coils are more difficult, and the apparatus herein described is intended to facilitate the formation of such coils.



Electric Railway Gazette

FIG. 1.—EICKEMEYER COIL.

If the armature be of the toothed type, as is frequently the case in railway work, there need be but one wire to a coil. If, however, it be of the smooth-core type, there must be two wires at least to every coil. This is so for several reasons: First, because when the surface of the armature is completely covered with wire the coil must have a small dimension to turn on edge when passing over the head, otherwise there will not be sufficient room; second, because the thin dimension, being in the line of the radius, the gap space is much reduced; and, third, because the radiating surface of the armature is largely increased. However, surface-wound drums are becoming quite uncommon in railway work, and we will therefore take up toothed types and the formation of coils for surface-wound drums will readily follow.

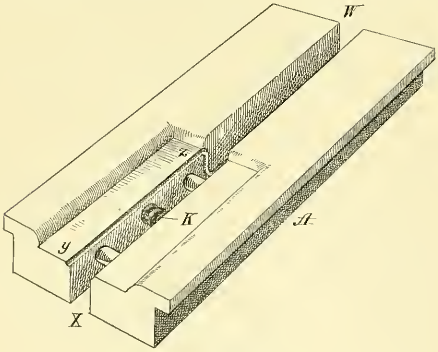


FIG 2.—FORMER.

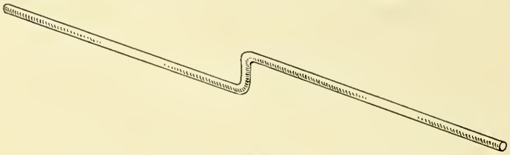


FIG. 3.—BEND IN CONNECTING PART OF COIL.

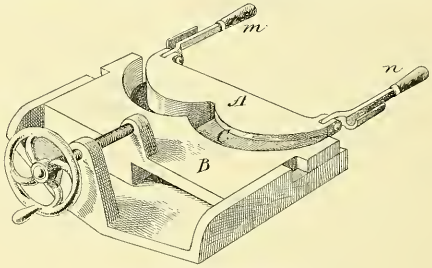


FIG. 4.—FORMING VISE.

The first thing to do is to form a piece of wire of the proper length, so that it will occupy the two planes. The spiral curves can then be readily bent. In order to accomplish this first object, a former, such as is shown in Fig. 2, will be found convenient. It consists of two iron castings, which are finished face to face along the line *X Y Z W*. The point *Z* is supposed to be the middle of the castings. Considering the castings as a whole, there is a depression in the upper part for half the length, and on the lower side of the other half a similar but deeper depression exists. The device is doweled together and a hole drilled in each side opposite and coincident, forming a pocket for a spiral spring. The device is gripped in a vise at *A*, and the spring in the pocket *K* tends to open the device when the jaws are relaxed. A hole is drilled at *Z* of such size as to give a chuck grip to the wire to be bent. The bottoms of the two depressions are planed to the proper levels, and grooves are planed, half on one piece and half on the other, so that the dividing line separates the groove. These grooves are of such size as to exactly contain the wire to be bent. The former is placed in the vise, as before stated, and the wire placed in the hole at *Z*. The wire is then hammered into the grooves on either side of the apparatus, the vise is slacked off, and the wire is removed bent as shown in Fig. 3. By properly shaping the former, the wire may be bent so that the distance, *X*, Fig. 5, may be anything desired. A boy can operate the former and turn out an average of 270 coils per day. Having thus kinked the wire, it remains to bend its spirals, and give the conductor portion the proper direction thereto. This may be done in a wooden or iron vise, preferably the latter, having specially formed jaws to give the wire its shape. A good form of this vise is shown in Fig. 4. The curved jaws, *A* and *B*, are forced together by the hand wheel and screw shown; *C* is raised above so as to properly support corresponding portions of the wire of Fig. 3. The closing of the jaws on the wire bends the spirals, and the conductors are bent upward in the proper direction by suitably formed levers, *M* and *N*, which press tongues into the two depressions left by the jaws to receive them. The arrangement of the vise is usually a matter of detail, and may be arranged to suit the manufacturer. The determining of the curvature of the jaws, unless done in a systematic manner, will be very difficult; a rule-of-thumb method cannot be successfully applied. In order to determine this curve for bipolar construction, which is the most difficult, lay out the iron diameter of the armature, full size if possible, and describe the circle; divide this circle into as many parts as there are conductors; draw from the same centre a circle whose circumference shall be equal to the sum of the diameters of one half the number of conductors. Select the position of two conductors you wish to join by a spiral connector, which is, of course, dependent upon the method of winding employed; it will be found very convenient, if not indispensable, to number each conductor. Having located these positions, as, for instance, *A* and *B*, Fig. 5, select a point, *C*, on the inner circle, equidistant from the two conductors to be connected, and on the side subtending the smaller angle. Make a stiff cardboard template and cut it approximately to shape to draw a line representing the side, *X X*, of the connector; pivot this template at the centre of the figure and draw the line, *X X*; move to a similar position, *D*, of the next conductor, taking that direction and again draw. The lines should be very nearly parallel, spreading out as they reach the outer circumference, and should be everywhere further apart than the diameter of the wire to be used; a little clipping and trimming of the template will soon produce the proper curve, and none but the proper curve will give maximum room between the wires. Having obtained a smooth curve, producing a maximum distance between lines, the other part of the curve, *Y Y*, may be sketched through points pricked by the dividers. Turning the template over and using the same pivot, the curve for the conductor *B* may be drawn; use the curve *X X* for one jaw and the curve *Y Y* for the other. It is possible to calculate and plot the curve exactly, but the template method is much more rapid and is accurate enough. Of course, if the teeth of the armature are too narrow the template cannot be formed so as to make parallel lines sufficiently wide apart to admit the wire, and in that case the winding is impossible unless a conductor with unequal sectional dimensions is used.

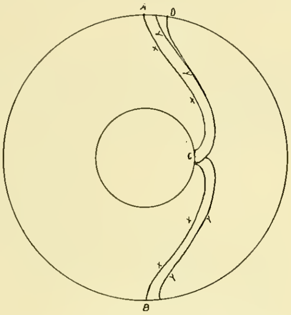


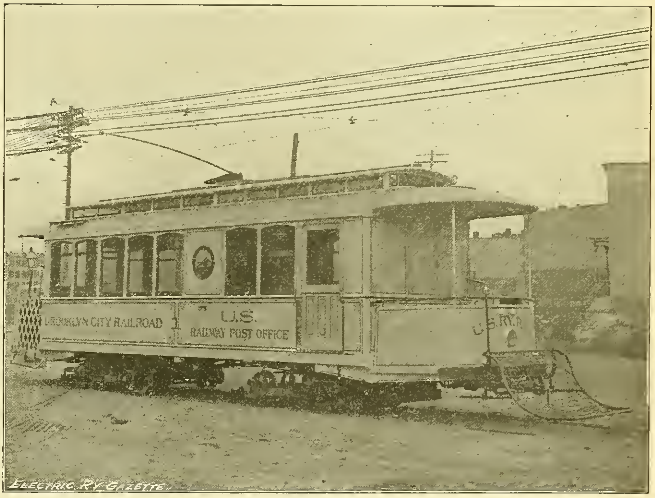
FIG. 5.—PLAN OF ARMATURE HEAD.

Postal Trolley Cars.

On Monday, Dec. 16, a number of invited guests were given an excursion on the five new postal trolley cars of the Brooklyn Heights Railway Company. Among those present were the Second Assistant Postmaster-General, the General Superintendent of the United States Railway Mail Service, Postmaster C. W. Dayton, and several other postal officials; Ex-Governor Flower, Congressman Felix Campbell, President Daniel F. Lewis, Engineer M. G. Starrett, and a number of other men prominent in public life and the electric railway industry. An elaborate lunch was served in the mail department of each car.

The trip, which was confined to part of the route on the main thoroughfares, occupied a little over an hour. The officials generally expressed themselves as well satisfied with the movements of the new cars and with their appointments. They will also be used as ladies' passenger cars, and run on regular schedule between the City Hall and Hunter's Point, by way of Myrtle Avenue, and the regular cross-town route, through Washington Avenue, and in Fulton Street, between the City Hall and East New York. Time tables will be placed in each car. They will make seventeen trips daily on week days and six on Sundays, and will be regular sub-post-offices; stamps, for example, may be purchased from them in any quantity.

The cars, which were built by the J. G. Brill Company, of Philadelphia, are 24 feet 8 inches long inside, and 35 feet over all. The mail compartment is 12 feet inside measurement, by 7 feet 4 inches wide; is fitted up with the standard steam railway post office fittings, consisting of 200 pigeon holes for distribution of mail, and with standard pouch racks, sorting tables, etc., and also furnished with a cooler for ice water and water for washing purposes.



ELECTRIC MAIL CAR.

The passenger compartment is also 12 feet in length, finished in natural cherry, with reversible Hale & Kilburn seat upholstered in spring rattan, and seating comfortably 20 passengers. Electric car bells are opposite each seat for signalling the conductor. The platforms are 4 feet 6 inches long, with rounded dashboard open on one side, and a large single door near the step, instead of in the centre of the car, as customary. They are lighted by eight lights in the passenger and ten lights in the postal end, and also furnished with platform lights and electric headlights. The passenger end of the car is equipped with the Consolidated Company's electric heaters, and the postal end with the Central Company's heaters. The cars are mounted on double trucks, eight wheels under each car, making a very comfortable, easy riding car.

These cars are said to be the handsomest postal cars run outside of the regular steam United States Railway Post-office routes.

Comments and Views of Contemporaries.

Mayor Pingree and the Citizens' Railway.—Mayor Pingree's attempt to enforce the sale of six tickets for 25 cents on the Citizens' Railway lines has so far resulted in his Honor being put off two cars and one man being put out of work. If he keeps this proportion up, it will not take long to deprive the Citizens' Company of all its employees, unless, indeed, all the rest of its conductors take their precedents from the conductor who put the Mayor off, instead of the man who let him ride free rather than have any trouble. His Honor has some notions of prescription and of the rights which accrue by custom. The charter of the company which the Mayor is now going to sue entitles it to charge five cents for every ride taken on its lines. There is little reason for belief that the fact that six rides have been granted for 25 cents for a long time wipes out the right to charge the full charter fare. From time immemorial almost, clergymen have been carried on steam railways at half fare, and other variations from the established rate. Could this be construed into giving them a prescriptive right to that lower fare? If the Mayor were guided by people who were not so largely interested in a personal way in litigation, both he and the town would be better off.—*Detroit Evening News.*

The Railway Strike.—With regard to the strike of the railway employees the situation on Wednesday was, in all its most important features, practically that of the preceding day; that is to say, anarchy and disorder were atop and law and order beneath. The existing civic condition, regard it how we may, is that of anarchy, in a city heretofore renowned for its respect for law, its observance of order. It is under these circumstances that some whose zeal is superior to their understanding of the real state of affairs, of the true meaning of the situation, are urging that the strikers shall be compromised with while they are still actually trampling the law and the peace and the security of life and property under their feet. The most ordinary intelligence would perceive that so long as the strikers make riot and violence, the overturn of law, the setting aside of order, actual conditions, there can be no compromise with them. Until the authorities shall afford to the companies authorized under the broad seal of the sovereign State to act as common carriers, the right to operate their lines in peace and safety; until every citizen who wishes to use the cars shall be secure in doing so; until every man who is willing to work shall be, without fear, let or hindrance allowed to do so; until the people shall walk the streets free from fear; until life and property shall have the amplest protection at all times and in all places; until riotous mobs shall not interfere with the business of citizens, and until law and order are recognized by every one as supreme, there can be no compromise. The law cannot compromise with crime, with riot, disorder, violence and intimidation. Apart from that, due consideration should be given to the fact that a comparatively small number of the employees of the companies are strikers. The greater proportion of them are not only willing but eager to work, and are prevented doing so by the strikers. Intelligent sympathy should go first with those who ask only to be permitted to earn the means of living for themselves and for their families; with the men who obey the law, respect order and maintain the peace. The present situation of mob rule is not only disgraceful to the city; it inflicts great losses upon our citizens, hardships and distress upon hundreds of thousands of workingmen and working women and children, who are compelled to walk long distances daily to and from their work, and it is a constant menace to life and property. It is a situation that is simply intolerable, and the authorities should use the means to end it.—*Philadelphia Public Ledger.*

The Economy Water-Tube Boiler.

It would seem that all possible combinations had been long ago exhausted in the many types of water-tube boiler, but the Economy Water-Tube Boiler Company furnishes conclusive proof that such is not the case, in the shape of the boiler shown in the accompanying illustrations. The designer of this boiler has worked with a view to providing excellent circulation, dry steam, and the proper introduction of feed-water.

Fig. 1 gives a view of the boiler, with the brickwork broken away to show the arrangement of tubes, etc., and Fig. 2 gives a shortened sectional view of the tubes, headers and drum. It will be noticed that there are two sets of tubes, one set inside the other, the arrangement at the front end being such that the water enters the *inner* tubes, passes to the rear and flows back to the front through the *outer* tubes, as indicated by the white arrows. The drum is suspended from steel channel beams, which are supported on iron columns independently of the brickwork. The connection between the saddle in the front end of the drum and the front header

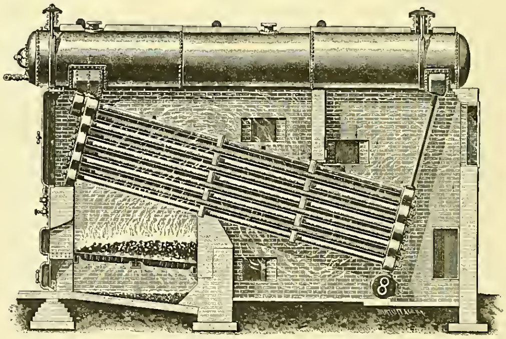


FIG. 1.—ECONOMY BOILER.

consists of extra heavy nipples expanded in; at the rear end lap-welded tubes are employed to connect the headers with the drum, and these are also expanded in both the saddle and the header.

The feed-water is introduced through the pipe, *U*, Fig. 2, which turns back and empties into the larger pipe, *T*, passing down into the headers, *P*, and through the inner circulating tubes, *S*, to the back headers, *G*, where it flows back to the heating tubes, *H*, to the main chamber, *A*, of the drum. The rear connections, *L*, serve to carry water down from the drum to the rear headers, *G*, where it combines with the circulation mentioned.

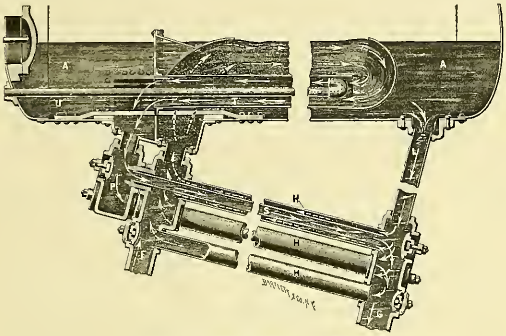


FIG. 2.—SECTIONAL VIEW.

A deflecting plate is provided in the drum to separate the steam from the water as it rises from the headers, *F*. The vertical connections are given ample proportions so as to assure free passage to the mingled steam and water, and avoid, as far as possible, any disturbance of the water level in the drum.

A hand-hole is provided opposite each tube, as shown in Fig. 2, which affords easy access for changing, and all hand-hole plates are on the inside of the headers so that the steam pressure tends to keep them tight. None of the joints are exposed to the direct action of the fire, and the heating surfaces are at right angles to the direction of the hot gases.

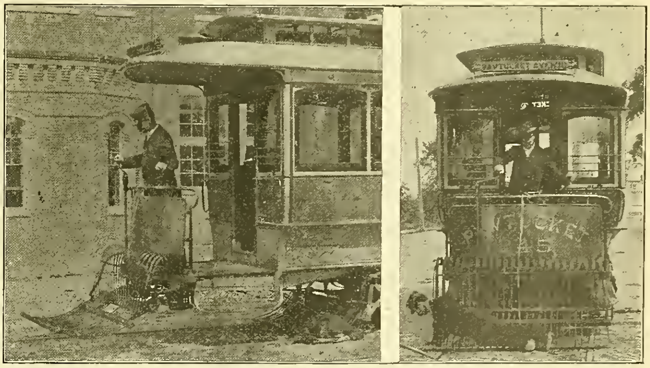
The Providence Car Fender.

The subject of fenders has been repeatedly discussed, and it is sometimes claimed by those who are reputed to know, that it is impossible to construct a fender that will not end more lives than it will save. The record that the Providence car fender is making for itself, conclusively proves that those who make the above statement are in error. It is perfectly true that it is not possible to build a fender that will invariably save life; but that it is possible to construct one that will save a very large percentage of lives, scarcely admits of denial, and the Providence fender is evidently one of this nature.

The fender has a definite principle and is not a simple scoop-net carried at the front of the car. The structural part of the fender is built of rods and spring steel. These rods are curved like the teeth of a hay rake, but instead of being pointed, are bent around an axis at right angles to the tracks and horizontal. Between each of the curved rods on the axis before mentioned turns a soft rubber roller bushed with a steel tube. The curved steel rods are hammered tightly into grooves in a wooden frame, and are locked in the grooves prepared for them by a single iron plate. The other part of the fender consists of a spring cushion built of flat pieces of spring steel, with just life enough to spring back, but too malleable to snap rather than bend. This forms a yielding surface against which any obstacle thrown into the fender may impinge.

The fender is attached to the car by the following ingenious method, which is so universal in its nature that it may be applied to any car without cutting it, whatever be the nature of the sill construction. A square plate with a large number of holes allows a universal adjustment of the bolts holding the supporting lever in place. This supporting lever carries a socket in which a point on the fender rests. Concentric with the point is a quadrant with an adjustable stop bolted thereto. The fender is maintained in an upright position clear of the tracks by a lever pivoted at the centre of this quadrant, and prevented from swinging a complete revolution by the stop. This lever is in the rear of the supporting socket, and therefore rises when the fender falls. To control this rising, the lever works in a slot in which a latch is interposed. This latch releases the fender at the pressure of a tread on the motorman's platform and the fender falls. Of course, the latch and lever device is duplicated at the other support, and the two latches work simultaneously.

This type of fender owes its success to the fact that when it strikes it is on the ground and not a few inches from it, and therefore riding over the victim is impossible. In case the motorman does not act promptly and the fender clears the object on the track, an automatic wheel guard is provided. As the car passes over the obstruction the latter swings a gate, thereby automatically unlatching the wheel guard, which drops and scoops up whatever may be in the way. This guard is built in a very similar way to the fender itself, but is adapted to work in the space assigned to it. Recently the Consolidated Car Fender Company has improved the wheel guard, so that it drops coincidently with the front fender. If, however, the motorman should neglect to spring the front fender, the automatic gate acts, and therefore the chance of the wheel guards not being dropped is almost nil.



CAR FENDER IN OPERATION.

The fender is extremely strong, and it is claimed that in several instances has picked up a horse, without injury either to the horse or the fender. None but the best materials enter into its construction, and it is withal shapely and even ornamental.

FINANCIAL NOTES.

THE LOS ANGELES RAILWAY SALE.—It is thought that suit will probably be brought soon to set aside the recent sale of the Los Angeles Electric Railway property. Bonds amounting to $400,000 were held by Chicago capitalists, the balance of $3,000,000 in bonds being held by San Francisco bankers and capitalists. The bondholders, in taking over the road to secure themselves, arranged in the reorganization of the company to give the former stockholders 40 per cent. of the stock, the bondholders retaining the rest.

MILWAUKEE, WIS.—The Milwaukee Street Railway escaped the payment of over $20,000 taxes by the passage of the law compelling it to pay a percentage in lieu of direct taxes. The company filed with City Treasurer Milbrath last week its statement of gross earnings from its passenger business. The gross receipts of the company for the year ending December 1, 1895, are $1,286,880. The tax which must be paid on these earnings according to the law passed last Winter is $21,987. The company would have had to pay $40,000 taxes under the old law.

SCRANTON TRACTION.—It is said to be a fact that the earnings of the Scranton Traction Company have been satisfactory from the start, and the nature of the territory traversed by the lines of the company makes it likely that there will be a gradual expansion of the volume of traffic. The showing for the month of November and for the five months ended Nov. 30 is given in detail, as follows:

	1895.	1894.	Increase.
MONTH OF NOVEMBER.			
Gross earnings	$26,709.73	$21,988.90	$4,720.83
Operating expenses	13,764.13	12,411.99	1,352.14
Net earnings	$12,945.60	$9,576.91	$3,368.69
FIVE MONTHS ENDED NOV. 30.			
Gross earnings	$139,374.98	$115,252.03	$24,122.95
Operating expenses	66,939.35	66,924.56	14.79
Net earnings	$72,435.63	$48,327.47	$24,108.16

The ratio of operating expenses to gross earnings is a noteworthy feature of the showing. For the month of November the expenses were only 50 per cent. of the earnings. For the five months ended Nov. 30 they were somewhat less than 50 per cent. The conditions for economy in operation are, of course, present in an exceptional degree, the item of coal being (not as usual with other companies) of small consequence.

NEW INCORPORATIONS.

CORRY, PA.—The Corry Street Railway Company has been formed by C. W. Sill, Charles B. Ayers and S. J. Franklin, Warren, Pa., for the purpose of building an electric street railway. Capital stock, $25,000.

WEST PITTSTON, PA.—The Pittston People's Electric Street Railway Company, capital stock, $50,000, has been organized by James Flynn, Joseph C. Reap and Michael J. Langan, Pittston, Pa., for the purpose of building an electric street railway.

AKRON, O.—The Akron Street Railway & Illuminating Company, capital stock, $1,500,000, has been formed by J. B. Clews, J. A. Long, F. A. Seiberling, E. G. Gibson, and Ira M. Miller, for the purpose of acquiring and operating a street railway, electric or other motive power to be used.

PORTCHESTER, N. Y.—The Portchester Electric Railway Company, capital stock, $500,000, has been formed for the purpose of building and operating a street surface road, 10 miles long, in Westchester County. Those interested are T. S. Krutz, C. H. Cummings, D. J. Pearsall and T. L. Cuyler, Jr., New York City.

CHARLESTON, WEST VA.—The Charleston Traction, Light & Power Company has been incorporated for the purpose of purchasing and owning lines of street railways, water-works and any and all factories, and for furnishing and selling water, electricity, etc. The incorporators are W. A. McCorkle, Malcolm Jackson, M. M. Williams, A. W. Watrous, Charleston, West Va. Capital stock, $500, minimum, and $500,000, maximum.

NEWS OF THE WEEK.

JOHNSTOWN, N. Y.—It is proposed to extend the line of Amsterdam Street Railway to Johnstown.

CORRY, PA.—A charter has been issued to the Corry Street Railway Company to build a line four miles long.

BLACKSBURG, S. C.—It is proposed to build an electric railway line from Salem to Blacksburg, a distance of 25 miles.

ST. JOHNSBURY, VT.—A syndicate from Burlington, headed by F. C. Kennedy and J. Pierson, proposes to build an electric road here.

McKEESPORT, PA.—The work of construction of the McKeesport & Port View Passenger Railway will probably be begun at the opening of next Spring.

CHICAGO, ILL.—The Englewood & Chicago Electric Street Railway Company has secured a permit to lay tracks under the franchise it secured May 2, 1893.

ANDERSON, IND.—Hon. C. L. Henry, president of the Anderson Electric Street Railway Company, is advertising for bids for the construction of a railway roadbed between Alexander and Anderson.

PROVIDENCE, R. I.—A syndicate of Rhode Island and Philadelphia capitalists has decided to build and operate an electric railway from Providence to Taunton, Mass. The capital is placed at $3,000,000.

PORTLAND, ME.—The Cape Elizabeth Electric Road is running regularly and doing a good business. Care has been taken in running the cars around the curve at the foot of Market Street and no serious trouble has been experienced.

FALL RIVER, MASS.—The Board of Aldermen has voted to grant the Fall River Street Railway the right to extend its tracks from Pine Street to Turner Street, through Durfee Street, a distance of about a quarter of a mile.

NEW BRIGHTON, PA.—The new incline up Patterson Heights is rapidly approaching completion, and within a few days electricity will convey passengers up the steep incline, where a magnificent view of the valley can be obtained.

CARROLLTON, KY.—If the town will raise $20,000, a company has agreed to build a bridge across the river at the request of the citizens. It is also proposed to construct an electric railway connecting Carrollton with several smaller places.

PITTSBURG, PA.—The Second Avenue Traction Company failed to secure the Martin's Ferry, Bellaire & Bridgeport Street Railway for which it was negotiating, a Wheeling company holding an option on the property. It is held at $300,000.

TACOMA, WASH.—H. E. Thomas, a civil engineer, of Seattle, who is said to have Eastern capital behind him, has been looking over the ground for an entrance to Tacoma for an electric railway, to be built between Tacoma and Seattle, distance, 32 miles.

ELIZABETH, PA.—A charter has been granted to the Pittsburg & Monongahela Traction Company. M. D. Bulger, of Brownsville, is president. The line will begin at West Elizabeth and run through the streets of Elizabeth and West Elizabeth.

TAUNTON, MASS.—The Fall River & Taunton Street Railway Company has petitioned for an amendment to its charter, which will extend its rights as a corporation to July 1, 1900, and permit it to build and operate a street railway between New Bedford and Taunton.

GREENSBURG, PA.—An electric railway starting at Derry and running to Latrobe, Youngstown, Whitney and the extensive Lippincott & Hostetter coke plants, and to St. Xavier's Academy, is shortly to be built by local capitalists. The road will be 20 miles in length.

AMHERST, MASS.—Success is attending the efforts of the committee appointed to solicit subscriptions for the Amherst electric road. C. A. Richardson, of the Worcester Construction Company, advises the promoters of the road to go through Sunderland instead of stopping at North Amherst.

MT. CLEMENS, MICH.—The Rapid Railway will ask the council for a loop line on Cass Avenue, Front and Howard Streets. From Howard Street a spur will leave for Shadyside Park, which the company will fix up as a pleasure resort. Freight will be carried between the hours of 6 p.m. and 8 a.m.

MADISON, IND.—The City Council has passed a resolution empowering the Select Committee, to whom was referred the matter of electric light and street railway, to contract with a competent electrical engineer to draw plans and specifications for a street lighting and electric railway plant in the city of Madison.

MILLBURY, MASS.—The plan of the car barn of the Blackstone Valley Electric Road has just been made public. The barn will be a modern structure in every particular. The main building will be 50 by 150 feet long. The company has made very complete investigations, and the most improved ideas will be applied.

RAHWAY, N. J.—The officials of the Union & Middlesex Traction and Rahway Electric Light & Power Company have stated that cars will continue to run and that the contract for lighting the city of Rahway will be carried out in spite of the fact that all of its employees have been dismissed. The company will secure a new corps of men.

PHILADELPHIA, PA.—The Law Committee's inquiry into the status of the trolley companies was very nearly blocked by a defeat of the resolution authorizing the Bureau of Highways to obtain all the information required by the committee and to employ additional help. Certain financial expenses caused its defeat, but later it was reconsidered and approved.

NEW YORK, N. Y.—The Independent County Organization advocates 3-cent fares on surface railways. In so doing, Charles Steckler said that the cost of surface railways of this city was $28,467,540, the capitalization $76,660,000, and the amount of watered surface railway stock $53,093,460. By means of the 3-cent fares $40,000 per day, or $14,600,000 per annum, would be saved the people of New York.

PITTSBURG, PA.—A charter has been granted to the City Incline Plane Company, the object of which is to build an incline railway from a point on Fourth Avenue over the Monongahela River to the top of Mt. Washington. The structure will be 3500 feet in length, 40 feet wide and have double tracks. John P. Moore, general superintendent of the Knoxville Land Improvement Company, is interested.

FORT WAYNE, IND.—A Cleveland syndicate, headed by John J. Shepperd, has just closed a deal by which the entire street car system of Fort Wayne comes into its hands. The capitalization of the consolidated company is $1,500,000, and a mortgage of $1,500,000 has been filed to cover the bonds of the company. It is stated that the syndicate will spend $300,000 in improvements on the property, extensions and additional equipments being intended.

MILLBRIDGE, ME.—Articles of association have been filed with the railway commissioners at Portland, by the company which proposes to build a branch road from Millbridge to Cherryfield. The corporation is to be called the Cherryfield & Millbridge Street Railway Company, and the road will start from Cherryfield, so as to connect the Washington County Railway at or near the upper corner, so-called, and run thence south through Main Street to Smith Street.

PROVIDENCE, R. I.—A plan is on foot for an electric road to run between Taunton and Providence. The new company will start with a capital of $300,000, with the shares placed at $10. The promoters are from Taunton, Dighton and this city. It is proposed to begin the tracks on the Taunton turnpike in East Providence, and extend them through Seekonk, Rehoboth and Dighton to Taunton, where connections will be made with the present trolley system. On this end the company will connect with the East Providence tracks of the Union Railway Company of this city.

TRADE NOTES.

THE FOREST CITY ELECTRIC COMPANY, of Cleveland, has met with such wholesale appreciation of its "roll-drop" commutator bars as to necessitate the operation of the factory day and night. A new type of commutator segment, designed for use with both styles of W. P. railway motors, has been added to the company's line of goods.

THOMAS G. OAKES, lately with Jenkins Bros., New York, and who has had an experience of 16 years in selling valves and packing, has engaged in business for himself at 52 John Street, New York. Mr. Oakes will put on the market a line of valves and packing made especially for him, and will also act as selling agent for the specialties of the Mason Regulator Company, of Boston.

THE PHILADELPHIA ELECTRICAL EQUIPMENT COMPANY, 816 Cherry Street, Philadelphia, has a fully equipped repair shop, and is making a specialty of heavy electric railway repairs. The concern has been in business for over a year as a firm, and made an enviable record in repair work; it has now been incorporated, and will spare no efforts to keep up to the high standard of work which it has already created for itself.

THE ABENDROTH & ROOT MANUFACTURING COMPANY, New York, defeated the suit instituted by the Philadelphia Edison Company, which alleged defective material and workmanship in a number of boilers sold the latter company by the former, the evidence showing, it is said, that the trouble experienced with the boilers in question was wholly due to excessive forcing and unusually impure feed-water. The boiler company also won a counter suit against the Edison Company for a balance due on the boilers.

H. E. COLLINS & CO., Pittsburg, Pa., sole sales agents for the Cahall vertical water-tube boiler, manufactured by the Aultman & Taylor Machinery Company, Mansfield, O., report the following recent sales of Cahall boilers: Douglas Furnaces, Sharpsville, Pa., (second order) 250 hp; Mahoning Valley Iron Company, Youngstown, O., (third order) 300 hp; Michigan Alkali Company, Wyandotte, Mich., (third order) 250 hp; Shoenberger Steel Company, Pittsburg, (seventh order) 500 hp; Traders' Paper Company, Lockport, N. Y., 500 hp; McKinnon Dash & Hardware Company, Troy, O., 100 hp.

ADAM COOK'S SONS, proprietors of the Albany Lubricating Compound & Cup Company, 313 West Street, New York, whose "Albany" grease has such an enviable reputation among engineers, will soon issue an elaborate catalogue giving the different results obtained by the use of the best oils and mineral greases in use to-day, in comparison with their Albany compound. Many street railways are using Albany grease with excellent results, and the manufacturers are constantly receiving numerous unsolicited testimonials, of which the following extract is characteristic: "We are using your compound all the time, and shall continue to do so, as we find it is the best lubricant we have ever tried."

THE ROBINSON RADIAL TRUCK COMPANY, of 620 Atlantic Avenue, Boston, Mass., as is well known, controls by foundation patents the principle that, while it is very easy to suppose two rigidly-connected points upon a railway curve, it is impossible to do so with four. They propose in the near future to embody this principle in electric locomotives designed for particularly high speeds. The Baltimore locomotive, as is known, is divided in the middle to obtain flexibility, but the Robinson Radial Company proposes to carry the matter further and have each pair of wheels so movable that their axes point to a common centre when rounding curves. Railway officials have always looked with much interest on the movements of this company, and the proposed venture is certainly a very attractive one.

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED DEC. 10, 1895.

550,941. BOND OR CONNECTOR; Adolph G. Carlson, Chicago, Ill. Filed July 13, 1895. In an electric railway, the combination of a bond having enlarged ends, a cone-shaped shoulder on said ends, a rivet or stud on the circumference of which said cone-shaped shoulder terminates, and a cone-shaped end of said rivet or stud, with the rails each provided with a hole through its web, said hole having beveled edges and adapted to receive the end of the bond which is to be expanded and firmly set therein by riveting. (See Illustration.)

550,962. RAILWAY CAR BRAKE; John Gibbons, West Troy, N. Y., assignor by direct and mesne assignments, of two thirds to John H. Jones, same place, and Stephen J. Brown, Troy, N. Y. Filed May 5, 1894. In a railway car, the combination with the car truck, and a rectangular frame, of a pivotal link connection between the truck and frame; a plurality of brake levers severally fulcrumed upon the frame; and a plurality of wheel-and-rail-engaging brake shoes severally supported by a brake lever, and means for oscillating the frame longitudinally of the car.

550,965. ELECTRICAL CONDUIT RAILWAY; John D. Griffen, New York, N. Y. Filed Dec. 5, 1892. The combination with the carriage having rollers, a trolley arm extending downward therefrom, and a conduit having a slot through which the trolley arm passes, of a tube with the conduit having a corresponding slot through which the trolley arm passes, arms pivoted within the tube, sections of cover carried by said arms, which cover the slot in the tube, and are provided with cams which are engaged by rollers to move the sections of cover to the open position as the carriage moves forward, and suitable means for returning the sections of cover to the closed position after the carriage has passed.

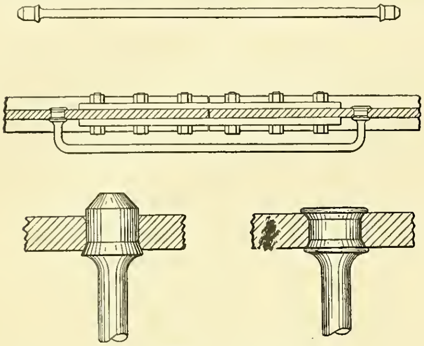
551,021. ELECTRIC RAIL-BOND; William H. Wiggin, Worcester, Mass. Filed May 22, 1895. An electric rail-bond comprising a bond wire, or rod, and four loose sleeves or collars, two at each end thereof, each set of said sleeves or collars consisting of an outer sleeve or collar having a tapered hole converging in the direction toward the body of the bond wire or rod, and an outwardly projecting, annular flange or rim at the opposite end from said bond wire or rod, adapted to fit against the rail flange when the sleeve or collar is fitted in the opening in said rail flange, and an inner sleeve or collar having a straight opening adapted to fit the end of the bond wire or rod, and made taper-shaped upon the outside, corresponding to and fitting in the tapered opening of the outer sleeve or collar, with the transverse outside diameter of the inner sleeve or collar a trifle larger than the opening in the outer sleeve or collar.

551,033. COMMUTATOR BRUSH; Robert Hirsch and Herman Meminger, Milwaukee, Wis. Filed Jan. 28, 1893. A commutator brush composed of alternating sections or strips of a lubricating and scouring composition and of metal, inclined or offset to the plane of rotation of the commutator so as to produce a continuous and approximately uniform area of metallic contact to the commutation in the direction of the width of the brush.

551,047. STREET CAR; William Robinson, Boston, Mass. Filed April 6, 1892. A car truss, consisting essentially of dependent brackets secured to the car frame at opposite sides of the journal box and independently of the pedestal, a rigid pressure brake connecting said brackets above the line of said journal box, said pressure brake being independent of the footboard, a pressure truss brake extending diagonally upward from the lower end of one of said dependent brackets to another pressure bracket secured at or near the outer end of said car frame, and a brace extending from the lower end of the other dependent bracket to a suitable resisting medium.

551,053. ELECTRIC CONTROLLER; Sidney H. Short, Cleveland, O. Filed Aug. 26, 1895. In an electric controller the combination with the controller shaft, of sleeves of magnetic metal mounted on and insulated from said shaft, contact arms of magnetic metal projecting from said sleeves, a magnet having a series of poles arranged in pairs, the poles of each pair being of opposite polarity whereby a magnetic circuit will be completed between the poles of each pair and through corresponding contact arms, and contact fingers disposed within said magnetic circuits. (See Illustration).

551,054. ELECTRIC CONTROLLER; Sidney H. Short, Cleveland, O. Filed Aug. 27, 1895. In an electric controller the combination with a casing having an iron base, of a shaft mounted in said casing, a series of sleeves of magnetic material mounted on and insulated from said shaft, each sleeve having arms of magnetic material, an enlargement on the base, in close proximity to which one arm on each sleeve is disposed, a series of contact fingers adapted to engage contact arms on said sleeves, an electromagnet secured to said magnetic base, and having pole-pieces terminating in close proximity to said contact arms and contact fingers, whereby a magnetic circuit will be completed from said pole-pieces to and through the contact arms and magnetic sleeve to the magnetic base and the magnet core.



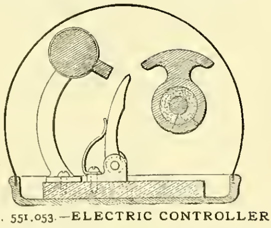
NO. 550,941.—RAIL BOND.

551,145. SWITCH FOR UNDERGROUND ELECTRIC RAILWAYS; Alfred Rosenholz, San Francisco, Cal., assignor of one half to Samuel J. Clarke and Harvey S. Brown, same place. Filed April 12, 1895. A distributing switch for electric conduits consisting of a magnetic core or conductor projecting at right angles with the main conductor, a sealed insulating casing fulcrumed and turnable about the main conductor and enclosing the core, a trolley wire supported from the movable end of the casing and connecting with the contact plate adjacent to the free end of the core and movable in the casing, a locking arm whereby the tilting of the casing is prevented, and a float connected with said locking arm adapted to throw it into engagement to lock the casing whenever the float is raised by a body of water around it.

551,168. TROLLEY; David Lippy, Ira E. Finfrock, George A. Rinehart and David R. Francis, Mansfield, O. Filed Sept. 24, 1895. The combination of the post, the mast pivoted to the post, oppositely extending arms on the post, having lugs at their respective ends, two parallel rods supported by said lugs, two bars upon the rods, a coiled spring on each rod, engaging both bars, and connections between the mast and the bars.

551,169. TROLLEY; David Lippy, Ira E. Finfrock, George A. Rinehart and David R. Francis, Mansfield, O. Filed Sept. 24, 1895. The combination of the block having two parallel openings, plates at each end of the block, a shaft passing through each opening, and projecting beyond both plates, a coiled spring encircling each shaft within the opening and engaging the same and one of the plates, two arms on each shaft where it projects through the plates, a mast head pivoted to the top of the block, and having oppositely extending arms above and in line with the transverse centre of the pivot, and chains connecting each of said arms and a pair of shaft arms.

551,197. CAR FENDER; Frank B. Scaife, Philadelphia, Pa. Filed Sept. 4, 1895. In combination with a car, a cross-bar, secured to one end thereof, having a series of arms pivoted thereto, said arms carrying vertical fingers at their outer ends, means for connecting said fingers, whereby when one is struck and forced backward the two adjacent fingers are caused to close forward.



NO. 551,053.—ELECTRIC CONTROLLER.

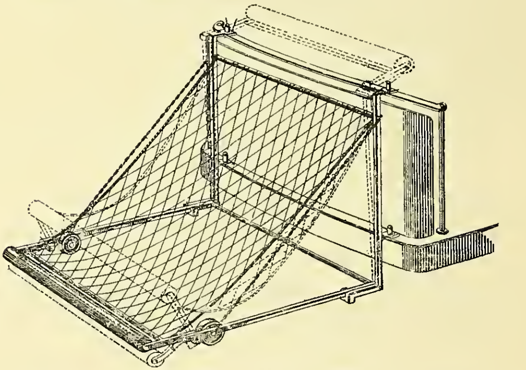
551,209. TRACK CLEANER; Arthur S. Hickley, Asbury Park, N. J. Filed April 5, 1895. The combination with a railway car of a vertically adjustable and revolvable brush provided with a horizontal axle extending from one side of the brush only and attached to the outer end of a bar which is pivotally connected at its opposite end to the car, the brush being supported to cross the rail of the track at an angle thereto, and in frictional contact with the side and upper surface of the head or tread of the rail and rotated by the motion of the car.

551,210. AUTOMATIC BRAKE AND SAFETY FENDER; John Kurtz and John G. Kurtz, Moore, Pa. Filed March 21, 1895. In a device of the character described, a cross-bar having suitable guides, a buffer connected with said cross-bars, a pivoted lever having a roller engaged by said cross-bar, springs bearing against said cross-bar, a sliding rod connected with said lever and having a coil spring thereon bearing against a stationary guide, a rock shaft with arms thereon supporting rods to which shoes are attached, a pawl connected with said sliding rod and engaging a catch on said rock shaft.

551,217. CAR FENDER; Patrick Long, Philadelphia, Pa. Filed July 18, 1895. In a car fender, converging arms hinged to attachments on a car platform, a standard to which the front ends of said arms are pivotally connected, and a fender frame secured to said standard and having a rear cross-bar with a standard thereon, chains connected with said platform and supporting the rear end of said frame, and a slotted plate connected with said platform and forming a guide for said latter mentioned standard.

551,231. CAR FENDER; William Purling, Philadelphia, Pa., assignor of half to Aaron E. Kempner, same place. Filed Aug. 31, 1895. A car fender consisting of side pieces, a front cross-rod joining the same, a buffer having a yielding connection with the front portion of the fender, the front and rear frames provided with netting, said rear frame being pivotally mounted adjacent to said front frame, which latter is connected to said front cross-rod, arms projecting beyond the pivotal point of said rear frame, and springs each having one attached to a suitable fixed point, and their outer ends to said arms whereby the rear frame of the fender is normally held in an inclined position.

551,241. CAR FENDER; Henry T. Vadors and Harper F. Smith, Philadelphia, Pa.; said Vaders assignor of two thirds to said Smith. Filed Aug. 2, 1895. In a car fender, the main frame, uprights with the laterally extending limbs on the lower end thereof, side pieces of said frame being mounted on said uprights and seated on said limbs, in combination with the roller-carrying frame, having its side-pieces pivoted to the said side-pieces and formed with lips embracing said pieces. (See Illustration.)



NO. 551,241.—CAR FENDER.

551,328. CAR FENDER; Samuel B. Willis, New York, N.Y., assignor to Michael C. Murphy, same place. Filed April 15, 1895. A car fender having in combination a series of transverse parallel bars or slates movable toward and away from each other in retracting and distending the fender, means extending within reach of the operator on the car platform for shifting said bars or slats, and a locking device on the car platform for locking said operating means to hold the fender in the desired position.

551,334. ELECTRIC RAILWAY; Robert Lundell, Brooklyn, N. Y., assignor to the Johnson Subtrolley Company, New York, N. Y. Filed June 9, 1894. In an electric railway a current feeder or main, sectional trolley conductors and switching devices for connecting them to the feeder or main in sequence; said switching devices having their controlling electromagnets connected together; an earth circuit connection for each sectional trolley conductor, and additional switching devices for rupturing said earth circuits, all of the switching devices being provided with non-fusible contacts whereby fusion or sticking of the parts is avoided.

11,518. RE-ISSUE. RAILWAY SWITCH; Edward Samuel and Victor Angerer, Philadelphia, Pa., assignor to William Wharton, Jr. & Co., Incorporated, same place. Filed Nov. 7, 1895. Original No. 545,820. The combination of the switch structure, a pivot opening therein, a switch-tongue wider at the base than at the top, and having a pivot pin depending therefrom, and adapted to snugly fit the opening in the switch structure, and held in position simply by the weight of the tongue and by the snug fit of the pin.

Electric Railway Gazette.

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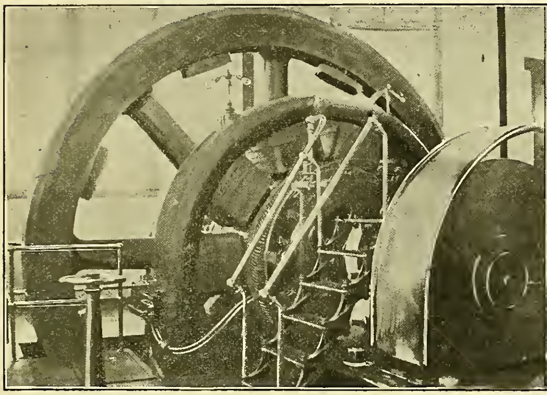
Power-Plant of the Nassau Electric Railway.

The power-plant of the Nassau Electric Railway, of Brooklyn, of which a provisional description was published in our issue of March 2 last, has since been in operation several months, and during the time it has been running no trouble whatever has been experienced. The power-house is located on a jetty in New York Bay at the foot of Thirty-ninth Street. The building is of the standard steel construction of the Berlin Iron Bridge Company, and measures 150 × 106 feet. The roof is of the anti-condensation type and is supported on steel trusses which in turn rest on steel columns. The walls are of brick, and large windows on all sides afford plenty of light and ventilation.



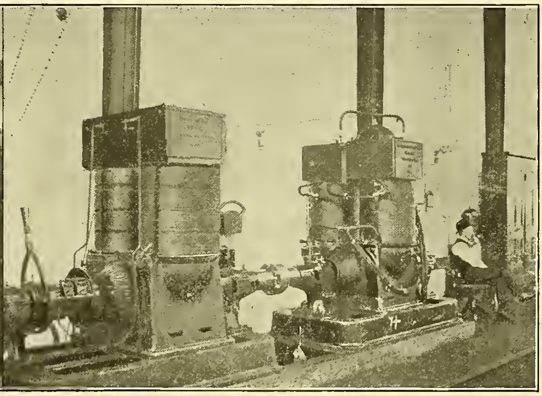
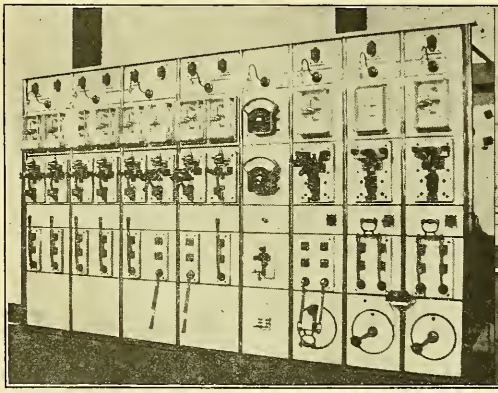


FIG. 1.—DIRECT-CONNECTED UNIT.

FIG. 2.—BOOSTER.

At present the power equipment consists of three cross-compound condensing Corliss engines of 750 horsepower each, directly connected to Westinghouse multipolar generators. The engines were built bythe C. & G. Cooper Company, of Mount Vernon, O., and were especially designed for electric railway work. The cylinders are 22 and 40 inches in diameter, with 48-inch stroke. The fly-wheels are 18 feet in diameter and weigh 40,000 pounds each. The engines are built on extra heavy solid bed-plates and provided with adjustable main bearings, by means of which the wear on the bearings can be taken up so that the space between the armature and fields may be maintained the same. The shafts are 18 feet in length and 15 inches in diameter in the bearings and 18 inches in the centre, with journals 30 inches long. The entire weight of each shaft and armature is 63,000 pounds.

The main steam lines are provided with butterfly valves, which can be operated by hand or by the governors. All the steam piping, as well as the electric wiring, is located under the engine-room floor, which is of cast-iron plates. The steam piping is duplicated throughout, and the danger of a complete shut-down



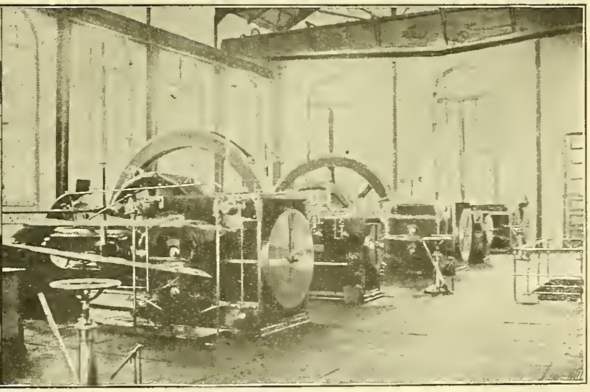


FIG. 3.—SWITCHBOARD.

FIG. 4.—THE ENGINES.

through any accident to the piping is reduced to a minimum.

The switchboard, shown in Fig. 3, is conveniently located in the centre of the room and is of the standard Westinghouse type, with white marble panels, equipped with Westinghouse and Weston instruments. The company proposes to try a system of boosters, a set of which is shown in Fig. 2.

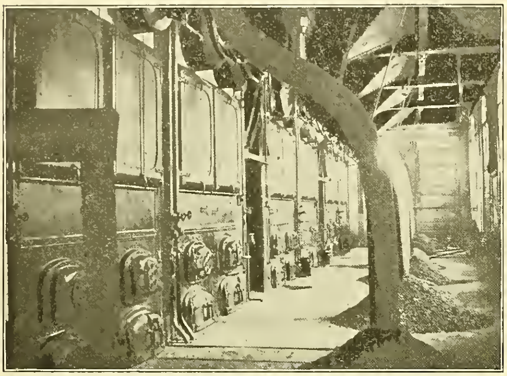


FIG. 5.—BOILER ROOM.

The engine-room is provided with a 34-ton traveling crane having a span of 53 feet and 6 inches. The crane was built by the Berlin Iron Bridge Company. A complete oiling system has been installed. The oil is contained in a reservoir located in the upper part of the engine-room, from which it flows by gravity to the bearings. From the bearings the oil passes through filters located in the basement under the engine-room floor, and is then pumped back to the reservoir. The station is provided with a compressed-air armature cleaning device, consisting of a Westinghouse air-pump and a receiver, from which hose connections extend to all parts of the engine-room. The system is also used for cleaning out the oil pipes.

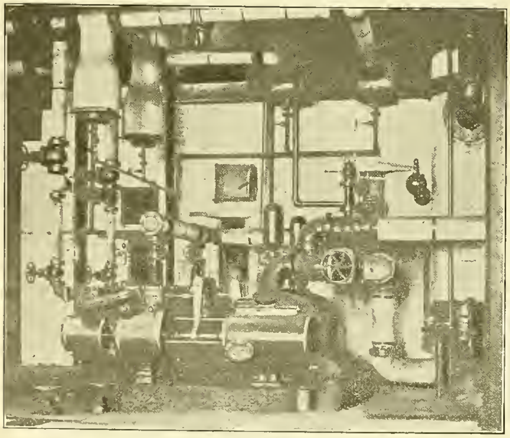


FIG. 6.—PUMP AND HEATER.

The boiler room is provided with six Babcock & Wilcox boilers of 250 hp each, arranged in batteries of two each. The facilities for receiving fuel are of the best. The location of the plant is such that the coal can be brought directly to the building on barges, from which it is conveyed to a hopper of 2000 tons capacity, located over the boilers, and thence coal chutes convey it directly to each furnace, as shown in Fig. 5. Seven Worthington surface condensers are employed, and the feed-pumps and circulating pumps are of the same manufacture. The stack is of iron with brick lining, and is 108 feet high and 10 feet in diameter in the clear. Provision has been made for increasing the power equipment, and two cross-compound Corliss engines of 1500 hp each will shortly be installed. The engines will be of the same type as those already installed, and will be direct-connected to generators. The company operates one of the most important systems in Brooklyn, and the construction of the road throughout is of the most substantial character.

The Philadelphia Strike Ended.

After a week of turmoil, strife and bitterness, the cars of the Union Traction system began running again Tuesday morning with almost their usual regularity. There were few evidences in the city that a strike, marked by determination on both sides, and marred by violence, had been declared off but a few hours before. The large force of police had disappeared, and there was a general feeling of thankfulness that the difficulties had been adjusted before the advent of Christmas.

From nearly every depot or car barn, and on most of the company's lines, cars began running under the regular schedules. All but a few of the old employees returned to work, and almost without exception they seemed satisfied with the terms of settlement. In many parts of the city flags were displayed as emblems of rejoicing that the week's tie-up and inconvenience were over.

A large number of the men brought from other cities to fill the places of the strikers quit work on Tuesday and returned to their homes, the Union Traction Company paying their expenses. It is said that about half the force of 1700 men left the city during the day. The old employees made the situation rather unpleasant for the new men, in many cases refusing to associate with them and in other ways indicating that their presence was undesirable. The early cars were manned largely by the imported men, but the insults and jeers they received on the first trips resulted in many leaving their cars when they returned to the car barns and requesting transportation home. Their places were promptly filled by crews of the old employees, who were waiting for vacancies. It is believed, however, that 400 or 500 of the force of new men will remain permanently. On several lines the cars carried flags or wreaths of Christmas greens. Many of the old men wore bows of white ribbon, signifying that they had been strikers.

During the early morning a few ignorant and evil-disposed persons threw stones and other missiles at the cars, breaking windows in several, and escaping arrest. Two cars of the Fourth and Eight Street lines were thus damaged. In some sections of the city disorderly crowds hooted and jeered the crews of imported men as they passed on their cars. There were a few attempts to block cars manned by the new men, against whom considerable animosity was directed.

The hundreds of wagons, hacks, coaches and nondescript vehicles which did a thriving business carrying passengers about the city disappeared on Tuesday like magic, and the cars carried almost their usual quota of passengers. General Manager Beetem remained at his office all Monday night directing the preparations for the resumption of regular travel.

President Mahon, of the Amalgamated Association, says that all but about 40 of the men who went on strike are working, and that almost the entire body of strikers are satisfied with the settlement. Between $3000 and $4000, he says, was collected for the strikers' relief fund Monday and Tuesday.

The loss to the city caused by the strike will never be known exactly. The loss to the merchants in the business section during what is usually the most profitable week of the year can only be approximated. It will probably reach $2,000,000 or more.

The loss to the company in receipts was, it is estimated, from $32,000 to $35,000 a day, a total of $230,000 to $245,000. The estimated loss to the strikers in wages is about $9000 a day, or $63,000. It is probable that the expenses and pay of the imported men, of the power stations, and the extraordinary expenses incident to the strike will about balance the items of wages, making the net loss of the company somewhere in the neighborhood of $230,000. The damage to cars will perhaps reach $8000, for which a claim will probably be made on the city. The extraordinary expenses of the city, as indicated by Mayor Warwick's request for an appropriation of $50,000, can be added to the figures already given, making a loss of $288,000 sustained by the company, the strikers and the municipality.

The unusually heavy travel on the lines of the Hestonville Company during the week of the strike subjected that company's power station and entire electrical equipment to a test of the most severe character, but there was not a single break-down, either at the station or on the line. The company ran many of its Summer cars to accommodate the heavy travel, and after midnight ran night cars 10 minutes apart. All the employees of the company worked hard and did much overtime. The company has shown its appreciation of this by distributing $2500 among its 350 to 400 men, on the basis of the work performed.

Railway Matters In Brooklyn.

The close competition of the two big trolley systems in Brooklyn, the Brooklyn Heights and the Nassau Company, promises to bring fares down and further improve the accommodations provided for the public. No reduction of fare is promised by the managers of the Heights system, but Mr. Flynn is reported as having said that it was his purpose to reduce the fare on the Nassau system to four cents and to extend the lines to Fort Hamilton and Flatlands.

President Rossiter, of the Brooklyn Heights Railway Company, is quoted as saying that next year many important changes would go into effect. It is the purpose of the company, he said, to extend the Nostrand and Flatbush Avenue lines to Bergen Beach, in Flatlands. Several improvements are to be made next year at Bergen Beach, and the new route should be very popular, for it will provide the people of Upper Brooklyn with the quickest means of reaching the water.

It is said that contracts have been made for the improvement of the roadbed of the lines in the Heights system, and that new cars will be purchased of a pattern similar to that in use on the Gates Avenue line, but of much greater seating capacity, and provided with double trucks, insuring comfort to the passengers.

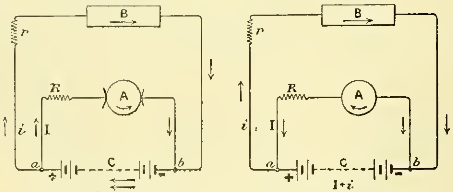
There are rumors of trouble between the Knights of Labor employed on the Brooklyn Heights system and President Rossiter. The men contend that the Brooklyn Heights and Atlantic Avenue railway companies sent nearly 500 motormen and conductors to Philadelphia to help out the Union Traction Company, of that city, during the strike there. They say that the "extra" lists at the car houses have been depleted by the wholesale exportation of the men.

Storage-Battery Traction.[*]

BY J. SARCIA.

I.—ON THE RECOVERY OF ENERGY.

Fig. 1 represents in diagram one of the motors of a new railway system that has been practically tried on the lines of St. Denis & Paris. This motor is shunt-wound; A is the armature and B the field magnet. A battery of storage cells furnishes current to the motor. In all that follows, a single motor only will be considered, the two being grouped in multiple. What is said of one will apply with equal force to the other. The arrows indicate the direction of the currents, i and I, in the two circuits, when the car is climbing or coasting and the motor receiving current. Two rheostats, r and R, regulated by hand, are under the control of the motorman, and enable him to vary at pleasure the strength of the currents i and I.



FIGS. 1 AND 2.—DIAGRAMS OF MOTOR CIRCUITS.

In general the motorman, by strengthening the current i which excites the field magnets, and weakening the current I which traverses the armature, diminishes the speed of the car, and by strengthening I and reducing i he obtains the reverse result. In practice to obtain maximum economy, it is best to use the armature rheostat R to get up the speed, cutting it out completely when speed is attained.

If we call ρ the resistance of the circuit, a, A, b, omitting the adjustable resistance, u the difference of potential between the points a and b, and e the counter E. M. F. developed by the armature, we may write according to Ohm's law:

$$I = \frac{u - e}{\rho}$$

Consider the car to proceed at a fixed position of the controller, and note what happens when it meets a grade greater than that which it would require, under the influence of its weight, to overcome the resistances of magnetic and mechanical friction.

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[*] From *L'Industrie Electrique.*

When the car starts on this grade it begins to descend with a uniformly accelerated motion, and as, by hypothesis, we have not altered the controller position, the armature turns with increasing speed in a constant field, for i does not vary.

The counter electromotive force, e, progressively increases, diminishing the value of I. At a certain instant $e = u$ and the current I becomes O. At this instant the battery and the motor armature constitute two generators which maintain the potential difference u between a and b, which causes the current to flow through the field magnets.

The speed of the car increasing, the armature of the motor which formerly received current becomes a generator. The current I which it generates divides, one part, i, serving to excite the fields, while the other, $I—i$, re-charges the battery(Fig. 2). At a certain instant the energy which is thus recovered becomes equal to the difference of the work done by the weight of the car and that consumed by the various resistance losses, and from this moment on, if the electrical connections are not changed, the car continues to descend the grade with a uniform velocity, that resulting from the excess of the energy of the weight over that consumed by the friction of the mechanism.

The recovery of energy is perhaps accompanied by a retardation of the velocity of the car. To compensate for this the value of the exciting current, i, may be augmented, thus increasing the armature flux and rendering possible the production of the same E. M. F. at a lesser speed. By diminishing this current, on the other hand, the speed of the car will be increased.

It is easy to see that if the necessary energy to excite the fields, which with well-designed dynamos is a very small percentage of the output, is not considered, energy is recovered on a determinable grade at a practically constant effective rate, whatever may be the velocity of the car.

Either climbing or coasting, retardation of the car is effected by strengthening the field; in consequence, the flux increases, and also the counter E. M. F. developed by the armature. Presently the e is greater than u and in the short time necessary to retard the car a part of the kinetic energy is thereby recovered by the battery. In case of a stop, therefore, all of the accumulated energy of the car is not lost, a certain portion being recovered by the storage battery.

II.—CALCULATION OF THE TRACTION COEFFICIENT.

The simple process of recovery of energy being set forth, let us call P the weight of the car in tons and f the tractive coefficient in kilograms per ton measured at terminals of the motor; this coefficient covers all the dead resistances of the car, mechanical or magnetic. If x represents in thousandths the rise of a length l in metres, it is easy to see that the work in kilogrammetres necessary to climb this grade measured at motor terminals is

$$P\,(x + f)\;l. \qquad (1)$$

If the term x has a value superior to f, the energy recovered by the battery equals

$$P\,(x - f)\;l. \qquad (2)$$

But as the efficiency of accumulators is, on the average, 70 per cent., the quantity of energy really utilized after recovery will be represented by

$$.7\;P\,(x - f)\;l\,; \qquad (3)$$

which we will call the useful recovered energy. If we call k the ratio of the useful recovered energy to the quantity of energy expended in climbing the grade, then it is clear that

$$k = .7\;\frac{x - f}{x + f} \qquad (4)$$

We will call k the coefficient of recovery. Before discussing this formula it is well to remark that the value of f varies in different cars according to the dead resistances of each car and the working of the motors which propel them, the type of the rail, and the condition the tracks may be in.

In the numerous experiments that I have made with the new car of St. Denis, the smallest value of f that I have been able to observe has been 7.6 kilograms per ton on the Vignole rail in the interurban section of the Paris-St. Denis line. The greatest value of f that I have noted was 15.7 kilograms per ton on the Broca rail in the city sections of the Paris-St. Denis line.

Formula 4 shows that for a certain value of f, k increases with x, that is to say, with the grade. In short, as the grade is augmented, the dead resistances tend to become negligible under the increasing influence of the weight of the car. In order to follow the values of k as x increases, assume for f a value of 10 kilograms per ton and construct the curve shown in Fig. 3.

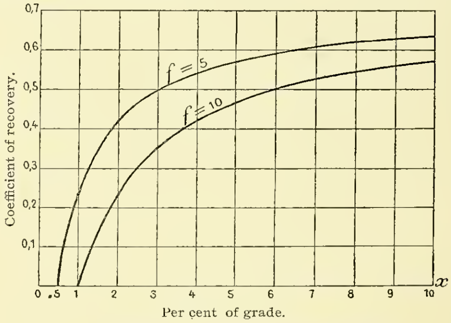


FIG. 3.—CURVES PLOTTED FROM TABLE II.

$$k = .7\;\frac{x - 10}{x + 10} \qquad (5)$$

The following table from which the curves are constructed gives the values of the coefficient of recovery on various grades and for different traction coefficients.

TABLE I.

	k	
Grade per cent.	$f = 5$	$f = 10$
0.5	0	——
1	0.233	0
2	0.420	0.233
3	0.500	0.350
4	0.544	0.420
5	0.573	0.456
6	0.592	0.500
7	0.607	0.525
8	0.618	0.544
9	0.627	0.560
10	0.633	0.572

We begin with a value $x = 0.01$ when $k = 0$, and we stop at the value $x = 10$.

For greater values of x it is not possible to obtain sufficient traction for cars in actual service, and if the track is sanded it makes a considerable increase of the value of f.

In consulting the curves and the corresponding table it will be noticed that with a coefficient of traction of 10 kilograms per ton, descending a 10 per cent. grade there is recovered in a useful form 57 per cent. of the energy required to surmount the grade. The quantity of useful energy diminishes with the grade; it is only 42 per cent. on a 4 per cent. grade, one of the steepest that occurs on Paris railways, and it falls to 25 per cent. on grades of 2 per cent., which is the average that Paris affords. Naturally it is zero on grades of one per cent. since we have assumed a tractive coefficient of 10 kilograms per ton on descents.

Table II and the corresponding curves in Fig. 4 give the values of the coefficient of recovery with respect to the coefficient of traction for different grades.

In reducing the dead resistances of the car, the value of f is correspondingly diminished. The general direction of the curve is not changed, but the values of k are sensibly increased for the same value of x. With a coefficient of traction of five kilograms per ton calculated at the binding posts of the car motors, there is recovered on descent a useful output of 63 per cent. of the energy necessary to climb a 10 per cent. grade. This may be compared with 57 per cent., which was obtained with a tractive coefficient of 10. With a tractive coefficient of five kilograms per ton a useful output of 25 per cent. recovered on a 1 per cent. grade, when with a traction coefficient of 10 the recovery was zero.

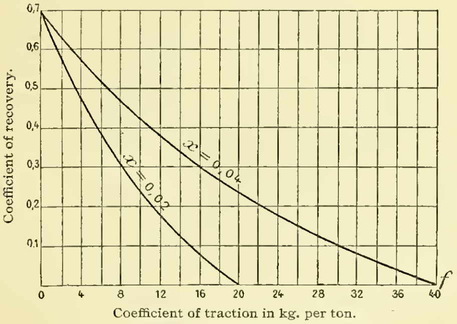


FIG. 4.—CURVES PLOTTED FROM TABLE II.

It therefore appears important to reduce the traction coefficient on descending grades if substantial recoveries of energy are to be made thereby. To demonstrate this necessity more exactly, we may, by means of formula 4, select values of k, corresponding to different values of f, and plot them in a curve; assume for x the value of 0.02, which represents the average grade on Paris tramways.

TABLE II.

Coefficient of traction kg. per ton.	Coefficient of recovery. k. $x=0.02$	$x=0.04$
0	0.70	0.70
2	0.57	0.63
4	0.47	0.57
6	0.38	0.51
8	0.30	0.47
10	0.23	0.42
12	0.18	0.38
14	0.12	0.34
16	0.08	0.30
18	0.04	0.27
20	0	0.23
22	0	0.20
24	0	0.18
26	0	0.15
28	0	0.12
30	0	0.10
32	0	0.08
34	0	0.06
36	0	0.04
38	0	0.02
40	0	0.00

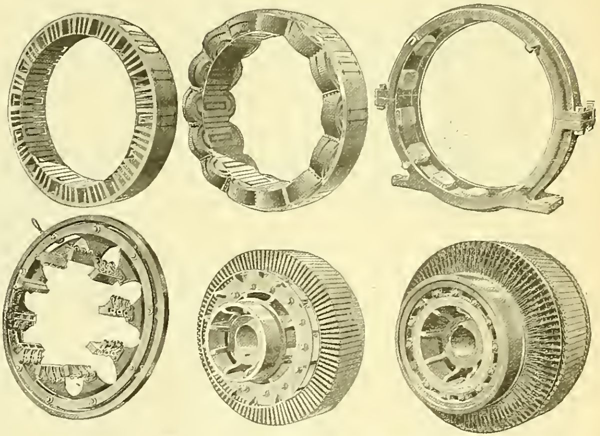
Under these conditions Table II and the curves in Fig. 4, which are constructed therefrom, represent the ratio of useful output recovered, to total energy used in a round trip for all values of f, x, the grade being 0.02. Descending 2 per cent. grade with a 0 traction coefficient, that is to say, with a car with neither electrical nor mechanical dead resistance, 70 per cent. of useful energy is recovered. This result is easy to predict, being merely the efficiency of the battery.

On the same grade the ratio of recovered useful energy to total energy expended falls to 57 per cent. with a traction coefficient of 2 kg. per ton, for a tractive coefficient of 10 kg. per ton, it is only 23 per cent., and it falls to 4 per cent. if tractive effort demands 18 kg. per ton. In descending a steep grade the general nature of the curve is not changed, but the value of k is considerably augmented for the same value of f.

(*To be continued.*)

Direct-Connected Generator and Engine.

The advantages obtainable in the construction of direct-connected engines and generators when both members of the set are built in the same works are by no means negligible. In the first place the engine bed and shaft do not have to be adapted to several different types of generator, or, looking at it from the other side, the generator frame and armature core do not have to conform to more than the one type of engine. The various parts of the two machines which have an inter-relation can all be standardized, simplifying the work of manufacture and facilitating the ordering of duplicate pieces. Moreover, the two machines are tested together and any defect or trouble in the one will not be laid to the other. The J. H. McEwen Manufacturing Company, of 26 Cortlandt Street, New York, appreciated these facts when it took up, some months ago, the manufacture of the Ryan dynamo for direct-connection with its own well-known automatic engines.



FIGS. 1 TO 6.—DETAILS OF DYNAMO.

The Ryan dynamo represents a radical departure in dynamo design, differing in nearly every detail of construction from the ordinary type of machine. The most important feature is a set of series-windings surrounding the armature, and termed balancing coils. This feature, which is the invention of Prof. Harris J. Ryan, of Cornell University, was introduced for the purpose of balancing armature reaction, and carefully conducted scientific tests show that it accomplishes the desired end perfectly. The field castings of these machines are of steel and consist of but three pieces, which are held together by four bolts. One of these castings is the "pole-ring," shown by Fig. 1, through which the balancing coils are wound, as shown in Fig. 2, and the other two constitute the field ring proper, shown in Fig. 3.

The balancing coils are wound in such a way that the current passes through them across the pole-face in the opposite direction from the currents in the armature conductors, and thus the magnetic effects of the armature currents are neutralized.

The field ring, Fig. 3, shows on its internal periphery the "pole-necks," around which the coils are placed. It will be seen that the ring is of such a shape as to entirely enclose the field coils, thus thoroughly protecting them from mechanical injury. It will be noted also that the space in the field ring allowed for the field coils is unusually small, and it is claimed that therefore less than one fourth as much energy is required to magnetize the fields of this dynamo as is necessary for a machine of equal capacity of ordinary design. On account of the small amount of field energy required, the rise in temperature of the field coils is very slight, notwithstanding the fact that these coils are so nearly surrounded on all sides. No compound winding is used on these dynamos, since, it is claimed, the balancing coils afford a compounding vastly more effective than the compound coils of the ordinary dynamo.

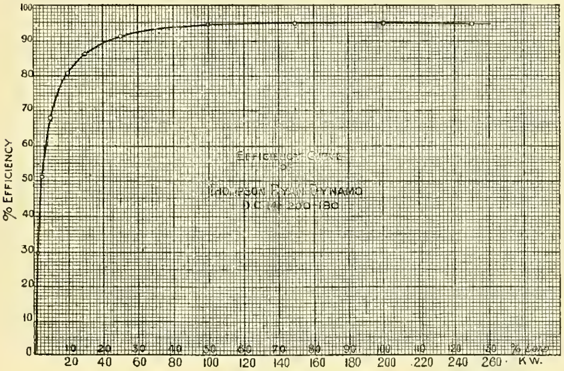
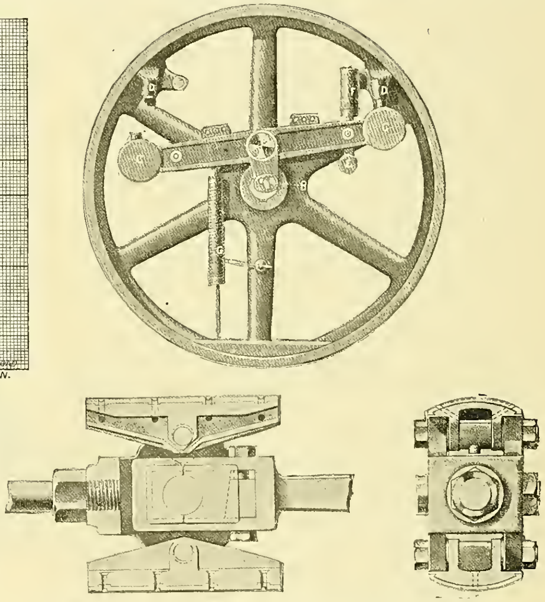


FIG. 7.—EFFICIENCY CURVE.

All of the armatures for the Ryan dynamos of whatever capacity, and whether wire-wound or bar-wound, are constructed on the same general style. The cores are built of thin plates of a special steel, the distinctive feature of which is its unusually low hysteresis loss. The plates are stamped out in the form of rings, and a series of long slots are punched near the edges. These rings are then clamped firmly to a central hub or spider by means of brass end plates. There are no bolts passing through the laminated core, and no iron comes in contact with these plates. As a consequence of this there is no leakage of magnetism and no development of potential in any part of the core to cause eddy currents and waste energy. The holes in the plates form "tunnels," in which the armature windings are placed. Fig. 5 gives a very good idea of the appearance of the finished armature core. It will be noted that the slots or tunnels are of unusual depth for this style of armature.

Another peculiarity of this machine is the large number of poles used. This feature, which in ordinary designs would be bad practice, is a valuable one for this particular style of design, enabling the builders to greatly shorten the armature conductors, and to use on all their armatures what may be described as the cylindro-hexagonal style of drum-winding. In this winding, all parts of every conductor of any particular layer on the armature lie in the same cylindrical surface, and the windings do not bend down over the end of the armature core at any point; the conductors being placed through the core and below the surface, no binding wire is necessary.

One of the noticeable features of these armatures is the ventilation. The armature being large in diameter, the central opening is also large and extends entirely through the armature from end to end, thus affording large heat-radiating surface. The principal ventilation is effected by the winding itself. The conductors cross each other in such a way as to form a sort of open lattice-work with innumerable radial openings through which the air circulates in great quantities, thus exerting a powerful cooling effect.



FIGS 8, 9 AND 10—ENGINE GOVERNOR AND CROSSHEAD.

The commutators are, as a rule, large in diameter and comparatively short in length. They are not mounted on the shaft, as is the usual practice, but are carried by a projecting ring of the spider. Fig. 6 is a view of the completed armature for a 200-kw direct-connected railway generator.

Fig. 4 is a view of complete brush-holder arrangement. The brush-holders project outward, leaving the entire outer end of the commutator free and accessible. The holders are very simple, and are so arranged that the brushes require no adjustment, but have only to be slipped into the holders. The whole brush-holder arrangement is adjustable around the commutator, and by loosening the clamp bolts the brushes may be shifted backward or forward. This is only done, however, for the purpose of adjusting the compounding of the machine. By shifting the brushes in this way the machines may be adjusted through a range of from 10 per cent. drop at full load to 10 per cent. rise, and this without any effect whatever on the commutation.

Fig. 7 shows a curve of commercial efficiency taken from actual tests of a 200-kw generator. The peculiar features of this curve are not so much the good efficiency under heavy load as the unusally high efficiency under light loads and the very great range of uniform efficiency. This is due to the unusually small fixed losses, the result of the very small field energy consumed and of the small losses in the armature core.

Another feature of the dynamo is the great ease with which two or more machines may be worked in parallel. The design of the machines peculiarly fits them for this sort of service. They may be thrown in parallel while differing widely in voltage produced, and each machine will take its due proportion of the load, notwithstanding the fact that they may be greatly over-compounded. Two or more of these machines will work perfectly in parallel, and divide the lightest load evenly or maintain perfect unison with the entire load thrown off.

The Ryan dynamos are built in sizes from 12½ kilowatts to 1500 kilowatts capacity, both belted and direct-connected.

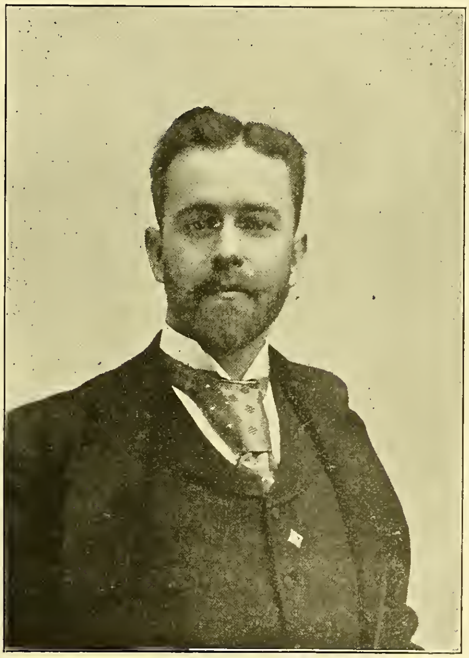
The McEwen Company has recently made some improvements in the details of its engine, notably in the governor and cross-head. Fig. 8 is a cut of the governor, which is extremely simple, having but one bearing, and that a roller pin bearing, which requires no lubrication, and as the spring is the only part that is adjustable, there cannot be any trouble from misadjustment.

Figs. 9 and 10 show the construction of the cross-head. The shoes are held in position by eccentric bolts. To adjust the position of shoes for wear, it is only necessary to turn the eccentric bolt to such an extent as is necessary to give proper adjustment. It will be noticed that the shoes swivel on the eccentric bolts, so that it is impossible for the shoes to have anything but a full bearing. Both upper and lower guides, as well as the cross-head pin, are oiled from stationary sight-feed oil-cups on top of the frame. The oil is wiped off by the upper shoe, and is caught in oil grooves shown, extending across the face of the shoe, and led through oil holes at each end of the grooves to inside of upper shoe; thence to a funnel-shaped oil hole in strap of cross-head box to cross-head pin; from there it drops to lower shoe and then through holes in this shoe to lower guide. The shoes are faced with genuine babbitt, which is put on in such a manner that it is as solid as though it were part of the shoe itself.

Street Railway Engineers—XXXI.

LEMUEL WILLIAM SERRELL.

Mr. Lemuel William Serrell, the subject of the accompanying portrait, is directly descended from the Huguenots, and can point with justifiable pride to a line of prominent ancestors. His grandfather was subjected to wholesale ridicule in London, for having declared the opinion that steamships would eventually cross the ocean. It was Mr. Serrell's uncle, General Edward W. Serrell, who, during the Civil War, commanded the engineer corps which placed in position the celebrated "Swamp Angel," for which purpose his subordinate officer had declared 500 men 18 feet high to be necessary.


LEMUEL WILLIAM SERRELL.

Mr. Serrell was born in Brooklyn in 1866, and after a thorough academic course, was graduated by Stevens Institute of Technology, Hoboken, with the degree of M. E., class of '87. Immediately after graduation he entered the employ of the C. & C. Electric Motor Company as its electrician, and was shortly made superintendent of the factory. He designed all the machinery which this company makes, comprising dynamos and motors up to 50 horse-power.

He resigned the position with the C. & C. Company in 1889 to accept a similar one at the Daft factory, in Marion, N. J., which he soon gave up to engage in electric railway construction work on his own account. He accomplished the passage of the first electric railway ordinance in the City of Baltimore, under which the Lake Roland road was built, and took a prominent part in the consummation of the project, both technically and commercially.

Mr. Serrell has built many electric railways and has had a wide and varied experience in this particular work. Among the railways constructed under his supervision are the Passaic, Garfield & Clifton, Paterson & Little Falls, New Jersey Electric (including all the work, car-houses, etc., between Paterson and Rutherford), Oswego Street Railway, Passaic & Newark Traction, Plainfield Street Railway, and the New York, Elmsford & White Plains Electric Railway. He is a member of the American Institute of Electrical Engineers, and is the author of an interesting and useful pocket-book for railway engineers.

Electric Traction in Spain.

A 60 years' concession has lately been granted to a company for the construction and operation of an electric tramway between Cadiz and San Fernando-Chulara. Work on the establishment of the line has just been commenced.

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STORAGE-BATTERY CARS.

In another column we print a translation of an able article by Mr. J. Sarcia, on storage-battery traction, which is appearing in *L'Industrie Electrique.* In the discussion he brings forward an idea advanced by Mr. Frank J. Sprague some years ago, that on storage-battery cars it is advisable to use a shunt motor and reduce car speed by strengthening the magnetic field. This produces a voltage at the motor terminals higher than that of the cells which it consequently recharges, and is an actual saving of energy that is now deliberately wasted by the brake-shoe. Mr. Sarcia has subjected the matter to mathematical discussion and deduced results that are very interesting and decidedly attractive to any one interested in electric traction. If this added advantage accrues in such a great measure to storage-battery cars, and if among the many storage-cells now advanced for traction purposes a commercially successful one is found, another formidable menace to overhead systems will result. Storage-batteries have long been subjected to disheartening failure through faulty construction rather than incorrect principle, and no true engineer can view with other than favorable feeling any substantial gain that may be effected by the able discussion of the method mentioned.

THE PERFECTION OF THE INDUCTION MOTOR.

The series-parallel controller has but two really economical running points, the others involving the introduction of wasteful resistance, and that this is duly recognized by engineers is shown by the extensive calculation and experiment which are now being carried on with a view to provide such methods of regulation as will render the induction motor suitable for railway purposes. The experiments are being pushed principally along the lines of varying the number of poles presented to the armature, and machines have been designed with as many as twenty-four poles, but have been abandoned on account of self-inductive action. Just why it is necessary to have as many running points as twenty-four poles afford is not clear. There is not a very material advantage in the induction motor till long lines and high potential incident thereto are involved. Such lines demand but few stops; why then should not three or four running points be sufficient for such cases? In designing apparatus for long lines engineers frequently forget that while the new difficulties are very grave, they are not, strictly speaking, added difficulties, for certain important considerations most potent in urban railway work totally disappear when long suburban and interurban lines are considered. For railway purposes the induction motor is mechanically ideal, and it will not be abandoned because the first crude experiments are discouraging. Important invention is rarely ever carried to completeness at the first thought; it is the product of experimental development.

One of our earliest electric railway systems was a *high-potential series conduit* system; could any method present more formidable difficulties? Yet it was pushed to a partial success that was not inconsiderable, and the experience gained has been most valuable.

PROGRESS VS. CONSERVATISM.

Experience has demonstrated that, no matter how beautiful or efficient a piece of mechanism may be made, there is always room for improvement, and energetic engineers are continually working to that end. There are no exceptions that do not plainly show their neglect. Conspicuous among these exceptions is that appliance so vital to electric railway interests—the trolley. It remains to-day substantially the same as it appeared when it made its first appearance. It is the same old troublesome device with the string attachment, giving evidence of experimental or amateur construction. Its leaving the wire at critical moments has caused many accidents. This lack of advancement is not because of any dearth of inventive ability, but because of lack of its encouragement. In the old trolley, managers have something that is cheap and does the work—after a fashion—and therefore decline to countenance improvement, particularly if it costs something. Unless substantial encouragement is given to inventive genius, it will forever lie dormant, and such conservatism constitutes a false economy which is by no means in keeping with the inherently progressive movement of electric traction.

STREET RAILWAY ECONOMICS.

Political economy is divided into three great branches, production, distribution and consumption, and the use of electrical energy on street railway cars is subject to the same division. Manufacturers will and do assist to their utmost to supply machines that will produce energy economically, but there their responsibility ends; with their large corps of experts they have succeeded in designing and building apparatus that is as near perfect efficiency as can be reasonably desired. The economical distribution and consumption depends upon the street railway manager. If he chooses to engage a competent engineer and spend money for copper to carry out his plans, an economical distributing system will result. This is very generally practiced. The economical consumption of energy has not been so carefully studied. The problem is to transport certain weights certain distances. To do this a car body and a truck are employed, in connection with a roadbed and rails. These are built for strength, durability, ease of riding and economy of first cost, but seldom economy of energy. When an electric car is transported over its route, there is no energy used that is not ultimately wasted in friction and diffused heat. This waste is always reducable by refinement of construction, and the refinements necessary to reduce the energy consumed under present practice are entirely negligible in view of the immense advantages gained, provided, of course, that such refinements do not entail complications which would jeopardize the reliability of operation.

SOME CONSIDERATIONS OF COST.

Before introducing a new device for a railway car, or abandoning an old one, it is certainly a wise precaution to multiply the results by the number of cars. Take, for example, a road operating 500 cars. A loss or saving of one half ampere per car means 250 amperes, or 125 kilowatts. With coal at $3 per ton, this means $3500 per year. A more economical motor, a better lamp or different heating apparatus, therefore, may effect a material saving. Electromagnetic traction systems are coming before public notice in the shape of experimental roads using a single car. It is entirely fair to multiply the leakage current by the number of cars which a railway company is using or proposes to use, and see if it can be afforded; a little calculation may produce startling results. But while such calculations may furnish a decided warning against some devices, they also serve to emphasize the merits of others. By a little experimenting and calculating, the station superintendent will be surprised to find how much initial expense he can afford to effect a comparatively trifling economy in operating expense; these calculations may refer to ball bearings, improved controllers or extra pay for trained motormen. Only careful and intelligent investigation will disclose the seat of many small losses which multiply rapidly, after which it is a matter of comparatively simple calculation to ascertain the proper means for their elimination.

CLEAN RAILS.

The high speed with which a long train of four or five cars is drawn on an elevated structure cannot fail to incite invidious comparison. Our vaunted trolley cars with motors aggregating 50 horse-power fail to make the time that a 200-hp locomotive makes with five cars of greater seating capacity. May we not look for a larger portion of this lost power in the rolling friction of dirty tracks? The rails of a road having exclusive domain, and especially of an elevated structure, are polished as bright as a mirror, and on those roads the smaller powers haul greater weights. The disadvantage of dirty tracks with regard to the serious arcing and the consequent softening of the chills, was recently pointed out in these columns, and a steel brush was suggested both to clean the track and afford additional electrical contact. It would appear that the cleaner tracks thus afforded, and the result of having obstructions swept away instead of being ground into the rails and causing their deterioration, might contribute to substantial saving in energy. The cost of steel brushes is comparatively small and the advantage gained by their general use, even if only 2 per cent. in saving of power and wheels, would amply justify the investment.

The Coventry (Eng.) Electric Railway.

[FROM OUR LONDON CORRESPONDENT.]

A new system of electric railway has just been completed and is now in operation at Coventry. The line was operated by steam until about two years ago. It is 5¾ miles long, and runs through Coventry, the villages of Foleshill, Longford and Exhall to Bedworth. The track gauge is 3 feet 6 inches, and the line is single track, with 27 turnouts. The gradients of the line are rather severe, 1 in 17 being the steepest. The worst curve is one of about 40 feet radius, this being at the top of the grade of 1 in 17, which makes it more difficult.

The power station is situated at Foleshill, 2¾ miles from Coventry. The buildings comprise a car shed to hold 12 cars, engine-room and boiler room. Babcock & Wilcox boilers of 106 hp each (at 30 lbs. water to 1 hp) have been supplied, while the engine-room contains two Browett-Lindley single cylinder, non-condensing engines of 120 hp each, which drive two Westinghouse 4-pole, 100-kw dynamos giving 500 volts. There are also two Sturtevant engines—one to drive the dynamo for lighting the buildings, the other to drive the Babcock mechanical coking stokers for the boilers, and also to drive some lathes and other tools in one end of the engine room The large engines run at 250 revolutions and drive the dynamos by means of belts at 925 revolutions. A Berryman feed-water heater is placed in one corner of the engine-room, using the exhaust steam from the engines.

The cars are fitted with Peckham trucks. Four of the cars are 22 feet, and six are 28 feet long. Eight are equipped as motor cars, two of the longer ones being used as trailers. Westinghouse materials were used almost exclusively. The overhead trolley system has been adopted. There are poles on each side of the road, except in a few places, where bracket poles are used. Through the city of Coventry most of the span lines are fixed to the houses. The feeder-wire is run on the poles at one side of the road, except through the city, where it is carried underground. It is made of Fowler-Waring armored cable. This is the second line opened in this country which has been constructed to meet the requirements of the Board of Trade regulations, the Bristol line, which has been running very successfully for some weeks, being the first.

A Canadian Long-Distance Electric Railway.

Street railway and electrical circles in the Dominion of Canada have been quite aroused by a legal notice appearing in Canadian papers, stating that application will be made at the next session of Parliament for an act to incorporate the Canadian Electric Railway & Power Company, with power to build, operate and maintain an electric railway from the City of Montreal in the Province of Quebec to the City of Windsor in the County of Essex, *via* Brockville, Kingston, Belleville, Toronto and London, and to build a branch line to Suspension Bridge (Niagara Falls), and other branch lines for a radius not exceeding 25 miles from any point or points on the main line; to enter into contract and arrangements with all existing or authorized firms or corporations along the said route, particularly with existing street or electric railway, light or power companies for the purpose of acquiring, leasing, amalgamating or making running arrangements with the same, or to supply same with heat, light or power; to establish, maintain and carry on street-railway services in such cities and towns on the line of said railway as the company and municipalities interested may agree on; to build said railway in sections as may be authorized; to acquire water-powers and sites for, and build electric works in connection with, said railway for the purpose of generating electrical energy; to acquire the right of way to transmit, and also the right to sell and otherwise dispose of electrical energy for heat, light, power and other purposes, and to distribute the same; with power to expropriate lands for the purposes of the undertaking, as provided by the Railway Act; with all other powers necessary for constructing and operating the said electrical works, and otherwise fully carry on the said undertaking, with power to issue paid-up stock of the company in payment of its obligations for all or any of the said authorized purposes, and with all proper or usual powers given or granted to companies incorporated for any of the purposes aforesaid.

The Buffalo Traction Company.

The Common Council of Buffalo granted, with only one dissenting vote, the 66-year franchise asked by the Buffalo Traction Company for a street surface railway in the city of Buffalo. Under the franchise four cents fare will be charged when no transfers are required, or five cents with a transfer. The new company, however, states that it is willing to enter into an agreement with the old company to give a system of free transfers over each other's lines. The four-cent fare will be arranged in rather a peculiar manner; each passenger will pay five cents, but if a transfer is not required, he or she will be given a rebate ticket, four of which will be good for a ride. These rebate tickets will be good for 60 days.

Some of the provisions of the franchise are very stringent, but Mr. H. P. Bissell states that notwithstanding this, the company will accept the franchise and build and operate the road. The franchise stipulates that the company shall begin actual construction of the road within five months after the acceptance of the grant, and shall within one year thereafter have finished and in actual operation 30 miles of its system, the remainder to be completed and in operation within three years from the date of the grant. It further provides that the company shall, whenever required, repave and keep in repair the portions of the street between the rails of its tracks, and for a space of two feet outside of the outer rails of each track so long as such tracks remain in the street. The company is also required not to shovel or brush snow, ice or other material into piles or ridges in the street, but in all instances where snow or ice is brushed or moved, it shall be uniformly leveled off in front of residences or places of business in such a manner as not to interfere with public travel or convenience.

The company is also required to provide vestibules for all closed cars, and to use cars of the best style and class obtainable, which shall be kept properly ventilated, lighted and heated; each car shall be provided with a fender at the front end. The Board of Public Works and the Common Council reserve the right to designate the method of heating, ventilating and lighting the cars, and in case such designation shall be made by them the company is to consider it as final.

The franchise also requires the company to pay into the city treasury 2½ per cent. of its gross receipts annually until the gross receipts shall exceed the sum of $2,000,000 per annum, after which time the company is to pay three per cent. of its gross receipts. The company is prohibited from consolidating or merging its capital stock, franchise or property with the stock, franchise or property of any other existing company operating in the City of Buffalo, and is not to be allowed to sell or lease its property or rights to any other company or companies without the consent of the Common Council of the city.

A Peculiar Accident.

It is reported that an electric car in Toledo, O., containing four passengers, was crossing the tracks at Western Avenue, of the Clover Leaf Railway, one day last week, when a light engine came along at a high rate of speed, lifted the car bodily from the rails and carried it fully 100 feet away before coming to a stop. The motor was badly damaged, but none of the occupants of the car were seriously bruised.

Proposed Alternating-Current Railway System.

A unique alternating-current railway system has been proposed by Messrs. Hutin and LeBlanc, according to *L'Eclairage Electrique*. The car carries an induction coil, built in sections, with a condenser in each circuit, and switches to effect various combinations of the windings. Current for the operation of the motors is induced in the coil by current flowing along conductors running parallel with the track. The object in dividing the windings of the induction coil is to secure regulation.

Trolley Line for the Brooklyn Bridge.

It is reported that the Nassau Electric Railway Company, of Brooklyn, has made a proposition to the Brooklyn Bridge Trustees to carry all passengers across the bridge free for one year, if the company is permitted to extend its system over the bridge to New York.

This company guarantees, it is stated, to run cars on ten seconds headway. The proposition says: "The company will agree to carry passengers across the bridge, to and from New York City, for nothing. It could provide for the carrying of over forty thousand persons per hour." Ex-Mayor Schieren is quoted as saying that this offer, in his estimation, is the solution of the bridge problem.

The Citizens' Railway Trouble in Detroit.

Mayor Pingree was ejected from one of the cars of Tom L. Johnson's company recently for refusing to pay full fare. He tendered the conductor a quarter and demanded six tickets, which were, of course, not furnished. He declined to pay five cents for a single fare and was requested to get off the car, which he did after some colloquy.

It is stated that mandamus proceedings have been instituted to compel the Citizens' Company to sell six tickets for a quarter, based upon the claim that the long-continued sale of tickets on the road up to the time Mr. Johnson acquired it constitutes a contract with the people, which the company has no legal right to invalidate. The original ordinance granted to the Detroit City Railway, Nov. 24, 1862, provides that the rate of fare "shall not exceed five cents."

Comments and Views of Contemporaries.

Watered Stock and the Public.—The talk of stock watering resulting in the "squeezing" of the interest on the increased number of shares out of the passengers is all sheer nonsense. With a small capitalization the same results would occur, the same net profits being distributed in this case as higher interest on the smaller capital. The increase of shares does not carry with it an increase of the passengers' nickels. The conductor does not collect fares on the basis of the company's capitalization, and where the "squeezing" comes in we are too obtuse to comprehend.—*Springfield Republican.*

The Philadelphia Strike.—The strike was not conceived or inaugurated by the strikers themselves. It is the fruits of the combined efforts of demagogic agitators and selfish or incompetent labor leaders; and when their cause is, by no act of theirs, identified with the cause of public disorder and danger to person and property, the strikers are entirely helpless, and it is only a question of how much they must suffer before they bow to the inevitable. They have been misled into revolutionary methods to redress real or imaginary wrongs, and all that they gained was a disordered city and 5000 homes without bread. The law gives absolute protection to the conductors and motormen of the Union Traction Company in refusing to work, but it must give just as absolute protection to every citizen who shall offer to take their places. On this point there can be no dispute. Whenever it shall be established that one class of men can hinder another class in accepting labor that is satisfactory to employers and employed, government is ended and anarchy is master. In such conflicts capital must suffer, but ten-fold more suffering must fall upon labor.—*Philadelphia Times.*

The Franchise Question.—One of the inevitable conditions of the growth of this country has been the valuable franchises which the large cities have been compelled to give away to corporations in order to secure street railways, gas and electric light plants and telephone and telegraphic service. Many of our cities of the first class have, however, now passed the formative period of their existence, and consequently there is a noticeable and gradual change of policy in their disposal of municipal franchises. Just recently New York City sold the right to build 15 miles of street railway through the streets of annexed districts north of Harlem River, to the Third Avenue Railway Company, for $250,000 cash and 38½ per cent. of gross receipts over and above 3 per cent. for the first five years and 5 per cent. thereafter. Some cities have already taken advantage of the option of buying the plants of corporations at the expiration of franchises. A better way, however, or, at least, a safer plan, is to renew at the expiration the franchises of the existing corporations, charging them a certain per cent. of the profits for the privileges granted, with certain restrictions and requirements. This plan has been tried by European cities with very good results. They not only secure better service thereby, but realize a good profit, and it also acts as a restraint upon councilmanic tendencies to corruption. At the same time the companies derive about as good a profit, proportionately, on their investment as are realized by companies of the same kind in this country.—*Council Bluffs Nonpareil.*

The Telephone Applied to Electric Roads.

An interesting application of the telephone to electric railway work has recently been made by the National Telephone Company of Boston. The conditions of the work were of such a nature that the ordinary instruments would not be at all satisfactory, as the wires were required to be strung on the same poles with electric railway feeders, and leakage and induction would have rendered an instrument of the usual type so noisy that nothing intelligible could be transmitted.

A diagram of the wiring is shown in Fig. 1. The circuit, as will be seen, is a series-loop with a closed system in which current normally always flows. Several cells of gravity battery, *M*, constitute the main battery, *X X* represent pole stations and are spring-clips between which a jack-plug may be thrust to insert an instrument in circuit. *D* is the receiving station, the apparatus of which is shown in Fig. 3; these are located at the power-house and the various company offices, and each has a definite tap signal.

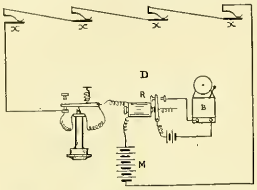


FIG. 1.—DIAGRAM OF CIRCUIT.

The instruments used are very simple, consisting of a double-pole magnetic receiver, and a granular carbon transmitter, adapted to pass a very heavy current. Both of the instruments are very small, and are mounted on a handle conveniently arranged to hold the receiver at the ear, and the transmitter in front of the mouth at the same time; no induction coil is used. The hand instruments are shown in Figs. 2 and 3 and are used at all the stations.

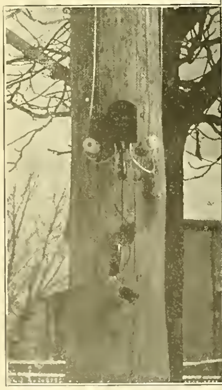


FIG. 2.—A STATION.

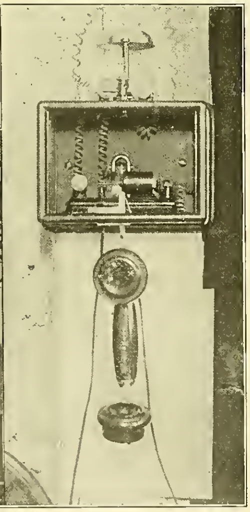


FIG. 3.—INTERIOR OF RELAY BOX.

On the handle of each telephonic set is a little push-button which opens the relay circuit at *D*, and gives the tap signal by means of the local bell *B*. The operator at the station signaled takes down his telephone and thereby cuts it into the circuit. The signaling party at the distant pole can now communicate with the station whose signal he has sent. In jacking in he listens for a moment to see if the line is in use, and then signals.

Every conductor is supposed to carry a telephone, such as is shown hanging to the relay-box of Fig. 3, which is so small and compact that it can readily be carried in an overcoat pocket. The pole stations are merely little cast-iron boxes, such as are shown in Fig. 2, and have an opening in the bottom into which the jack-plug may be thrust. By means of this telephone system much time may be saved in an infinite number of cases. It is stated that these instruments are proving eminently successful on a line built after the above description, and in spite of the heavy battery current, and the induction and leakage of the power wires, speech is transmitted with ease.

FIG. 4.—REPORTING TO HEADQUARTERS.

The Swinerton Polygonal Wheel.

It is some years since this wheel was introduced in railway circles, but its use has been confined to steam roads. The inventor is now trying to set his methods before the electric railway managers. The Swinerton Wheel Company has succeeded by the aid of its able iron founders, the Lobdell Company, in producing a wheel of the Swinerton design with facets which are true and plane. This is done in one casting without tooling of any kind, and the chills on these wheels are remarkably deep, comprising nearly all the rim. The brake-shoe of the Swinerton wheel rests upon the flange and a special brake rim, and does not bear upon the tread, so that the facets of the wheel are not worn by the action of the brakes. It is well known among railway men that it is impossible to "run" a flat place out of a wheel, and this is equally true of the facets of the Swinerton wheel; the flat places appear perfectly well defined and symmetrical, even after 10,000 or 15,000 miles of running. A number of exhaustive tests were performed by the Swinerton Company to ascertain the effective gripping contact between a locomotive wheel and the rail which is popularly supposed to be fairly represented by a mark $\frac{1}{4}$ inch broad and the length of the tread. The tests were made by jacking up the locomotive, placing prepared paper under the wheels, and letting the engine down. It was found by the investigators from these records that the contact was never equal in length to the width of the tread, and always less than $\frac{1}{16}$ inch in width. A Swinerton 33-inch wheel has 102 facets, and it is claimed by the company that these wheels will obviate the necessity of salt or sand and show an increase in tractive effect as compared with round wheels, of from 20 to 30 per cent. according to conditions.

Multipolar Generator.

A line of carefully designed and substantially constructed generators is being built by the Gates Manufacturing Company, of Chicago, one of which is represented in the accompanying engravings. These machines present no erratic or radically original features of design, the object being to produce plain, efficient and reliable apparatus rather than machinery embodying eccentric ideas of doubtful practical merit.

Fig. 1 shows a dynamo with the armature brushes and one pedestal removed, and Fig. 2 shows the same machine entirely dismantled. While the general design of these machines is entirely conventional, as above stated, there are some new features in the minor details which contribute to convenience of repair and handling. The commutator segments are independently removable, so that in case a single bar becomes accidentally damaged in any way it can be replaced with ease, and the necessity for turning down the whole commutator in order to "true out" the single damaged spot is obviated. Each magnet core and pole-shoe is cast in one piece of soft, low-carbon steel, and bolted to the ring frame, which has very short radial projections, faced off to make good magnetic contact; this construction allows the removal of any magnet core and coil without removing or disturbing the armature.

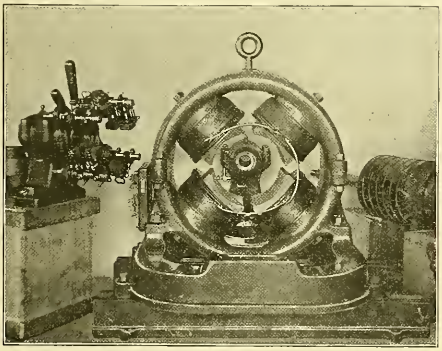


FIG. 1.—GENERATOR WITH ARMATURE AND BRUSHES REMOVED.

The armature and commutator are mounted upon a cast-iron sleeve independent of the shaft, so that in case of accident to the latter it may be removed bodily without disturbing in the least the armature core, coils, or connections. The armature is slot-wound with a flexible bar system of conductors which greatly facilitates the handling of the coils and contributes to the cool running of the machines.

Among other good features which go to make up an excellent combination are low magnetic density throughout the field-magnet circuit; low and current density in armature conductors; large ratio between field and armature ampere-turns; the simplest of brush-holders and general arrangement; self-aligning and oiling journals which do *not* generously distribute oil where its absence is preferable; and moderate speed. The machines are built for belt-driving or direct connection, as may be desired.

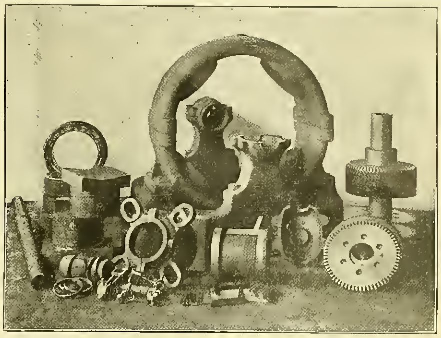
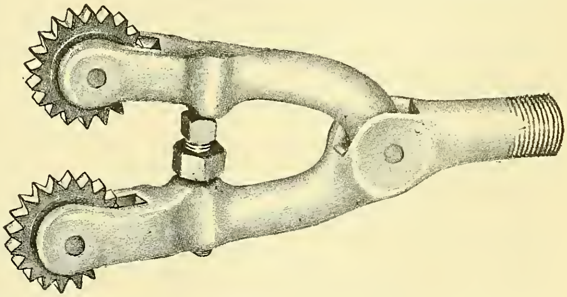


FIG. 2.—GENERATOR DISMANTLED.

The Haller Boiler-Tube Cleaner.

We illustrate herewith the Haller boiler-tube cleaner, which is being put on the market by the McClain Manufacturing Company, of Pittsburgh, Pa. Boiler-tube cleaners, as a rule, are provided with springs to force the arms apart, and the consequence is that when the tool is used in a tube and brought in contact with an unusually heavy deposit of scale, these springs are apt to contract sufficiently to permit the cleaner to pass over an obstruction without removing it. The Haller tube cleaner provides for such cases as this, and is equally applicable to all other uses. The set-screw shown prevents the jaws from contracting, and a passage must be cut through a deposit before the tool can possibly get any farther. No injury can be done by the tool, as it is set a size smaller than the inside diameter of the tube, and its power will not be exerted except where there is a coating of scale between the cutting wheels and the side of the tube. The tool, which is the invention of a practical engineer, is constructed in the strongest possible manner, the body being of cast steel and the cutting part of the best tool steel. All the parts are interchangeable and should any of them become broken or injured in any way, they can easily be replaced.


BOILER TUBE CLEANER.

FINANCIAL NOTES.

GEORGETOWN, DEL.—The stock of the electric railway from Lewes to Rehoboth, for which a charter was granted by the last Legislature, has been subscribed. The amount was $25,000, of which $2500 has been paid in. A survey of the route, which will be by way of the bay shore opposite Lewes by the government pier to Cape Henlopen life station, thence to Rehoboth along the ocean front, entering the corporation at or near McClear's cottage, will be made in a few days. There are several advantages for this route, the most important being that no damages will be required for land. Work will be begun before Jan. 1, 1896.

THE PITTSBURG CONSOLIDATION.—The stockholders of the Pittsburg, the Duquesne and the Central Traction Companies met on Monday, and ratified, by a large vote of the stock, the terms of lease for 950 years to the Consolidated Traction Company. The Pittsburg Traction Company goes into the combination with a guarantee of 7 per cent. on the par value of the stock; the Duquesne on a basis of 4 per cent., and the Central on a basis of 3 per cent. on the par value of stock. The combined capital stock of the consolidation is now $10,400,000 and the bonded debt $4,500,000, as follows: Central, $900,000; bonds, $500,000; Citizens', $8,000,000; bonds, $1,250,000; Duquesne, $3,000,000; bonds, $1,500,000; Pittsburg Traction, $2,500,000; bonds, $750,000; Fort Pitt, $1,000,000; bonds, $500,000. The latest talk is that neither of the Northside lines will be included in the combine.

NEWS OF THE WEEK.

ASHEVILLE, N. C.—An electric railway is to be built between Asheville and Biltmore.

PENN YAN, N. Y.—It is reported that the Fallbrook Railway contemplates an extension of its line from Penn Yan to Hammondsport.

HOBOKEN, N. J.— The Jersey City, Hoboken & Rutherford Street Railway Company has asked for right of way for its tracks in the city of Hoboken.

LITTLE FALLS, N. Y.—The Highway Commissioners of the town of Columbia have voted to grant the franchise asked for by the Little Falls & Richfield Springs Electric Railway.

SANDY HILL, N. Y.—Allen Bros. Company contemplate running an electric road in connection with their works, and have received permission from the trustees to do so.

NORTH TONAWANDA, N. Y.—At a meeting of the North Tonawanda Council the matter of granting the street railway franchise to Martinsville was deferred until a future meeting.

ORANGE, N. J.—A large meeting of the residents of St. Cloud was held recently to consider the matter of the extension of the Suburban Traction Company's lines to the top of the mountain.

MOODUS, CONN.—Moodus people are talking of raising capital to build the Moodus, Marlborough & Glastonbury Electric Railway, to connect at South Glastonbury with the Hartford line.

NEW BRIGHTON, S. I., N. Y.—The New Brighton trustees have approved the contract with the Thomas syndicate for the construction of an electric road upon Castleton Avenue, West New Brighton.

PITTSBURG, PA.—The Central Traction Company has restored the wages of its employees to the rate paid in 1893. It was the last corporation of its class to reduce wages, and is the first to restore them.

GREEN CASTLE, PA.—A new electric car line is projected at Green Castle, by Hugh Keogh, a contractor, of Lancaster, Samuel A. Miller and Edward Saxman, of Latrobe, and some Pittsburg capitalists.

MONTREAL, QUE.—The Street Railway Company has been granted the permission by the Road Committee to build a line on Mount Royal Avenue. The extension will mean about four miles of additional track.

LOWELL, MASS.—The Reading Electric Company's cars will be compelled to stop at Bellerica Centre until they are properly provided with fenders, after which they may run into Lowell on the Lowell & Suburban line.

QUEBEC, QUE.—The shareholders of the Montmorency Light & Power Company have decided to accept the offer of the Electric Street Railway Company for the purchase of the stock and franchise of the former company.

LOCKPORT, N. Y.—Engineer Dietz, of Buffalo, and Milton Tennant, of Lockport, are securing the rights of way for an electric road from the end of Michigan Street, Lockport, to Buffalo. The proposed line will be extended to Wilson.

BRIDGEPORT, CONN.—Col. H. N. Heft, who has charge of the electrical department of the Consolidated road, has introduced a double headlight on the Air Line flyer. The innovation has proved very satisfactory, and will probably be universally practiced.

BOSTON, MASS.—The residents along the Warwick & Oakland Beach Railway in Rhode Island are circulating a petition addressed to President Clark, of the New York, New Haven & Hartford Railway, asking that the Oakland Beach branch be equipped with electricity.

PITTSTON, PA.—The Pittston People's Electric Railway Company, recently chartered, proposes to construct an electric railway eight miles in length, between Pittston and Wilkes Barre. Directors, Joseph H. Glennon, West Pittston; Joseph C. Reap, Michael J. Langan, Pittston, and John T. Lenahan, of Wilkes Barre.

NEWMARKET, ONT.—A meeting was held recently in regard to the proposed Ontario & Lake Huron Electric Railway, at which Mr. Pey, the promoter, stated that he had been requested to extend the line to Goderich by way of Wingham. The Dominion and Provincial governments have granted bonuses to the extent of $6200 a mile.

LOWELL, MASS.—The electric road between Lowell and Lynn is not quite complete in all its details, but nevertheless a number of people have made the trip. The scenery through which the road passes is most picturesque, and it will prove a very desirable pleasure trip during the Summer season. The complete fare is 40 cents; time, three hours.

PHILADELPHIA, PA.—Both branches of City Councils have voted to appropriate $50,000 to the Department of Public Safety to meet extraordinary expenses incurred during the recent strike. The Common Council has passed an ordinance permitting a siding on Market Street for trolley mail cars, with the proviso that an additional license of $50 be imposed on each mail car.

DEDHAM, MASS.—The Dedham selectmen have unanimously voted to grant a franchise to the Norfolk Central Street Railway Company, for its proposed railway to Norwood and West Dedham. The total length of the road will be 10 miles and will be standard guage. Hon. John R. Bullard, Thomas T. Robinson, Ferdinand F. Favor, all of Dedham; Francis Doane of Norwood, and A. A. Whittier of Boston, are interested in the company.

LANCASTER, PA.—A car of the Lancaster & Lititz Electric Railway jumped the track Wednesday night, three miles from this city, with disastrous results. It had just descended a hill and was running at a high rate of speed, when the accident occurred. For fully 100 feet the car bounced along on the roadbed, and then, swerving to one side, crashed into one of the trolley wire poles, snapping it off. The front end of the car was knocked in, and a number of the passengers were seriously but not fatally injured.

CHICAGO, ILL.—The Metropolitan Elevated Railway Company had a very serious accident Monday morning about 3 a. m. One of their big handsome motor cars is to be seen hanging over the superstructure of their road at West Forty-eighth Street. This west-bound motor became unmanageable as it neared the Forty-eighth Street terminus, and fell to the ground a distance of about 20 feet. The cause of the accident is beyond the comprehension of the officials of the road or the motorman, beyond the fact that the brakes refused to act.

PHILADELPHIA, PA.—The committee appointed at the recent mass meeting in the Academy of Music adopted resolutions on Thursday urging City Councils to take action which will speedily result in vesting in the city the ownership of its street railways, "so that the city may be in a position to lease them to the highest and best bidders, for limited periods and under proper conditions and restrictions." The committee also urges the nomination of councilmanic candidates who will favor the purchase of the street railways by the city.

MILWAUKEE, WIS.—The directors of the Milwaukee Street Railway Company propose to extend various lines next Spring, among them the following: The State Street line is to be extended to Third Street, one block of track between Seventh and Eighth Streets being already laid. The Oakland Avenue line is to be extended from Park Place to the city limits, and the Forest Home Avenue line to Layton Park. The directors are also considering the substitution of electricity for steam on the Whitefish Bay line, and the building of a spur to North Milwaukee.

ORANGE, N. J.—Watson Whittlesey, a real estate dealer, is at the head of an enterprise to build a trolley line on top of the Orange Mountain. The road, if built, will run from Morris Street to Northfield Road, Dane's Road, Fairview Avenue, Prospect Avenue and Eagle Rock Avenue. It will run close to the park and along the brow of the mountain. There is a strong desire for the road by property owners on the mountain, and the residents on Prospect Avenue will donate five feet on each side of the street, so as to make the thoroughfare wide enough for the trolley and for carriages as well.

TRADE NOTES.

THE GRAHAM EQUIPMENT COMPANY, of Boston, is contemplating placing its business in the hands of a large company. If the deal is made the company will have the facilities of a large manufactory and will thereby be enabled to handle as large contracts as may be necessary.

THE FALK MANUFACTURING COMPANY, of Milwaukee, reports a flourishing trade. The company is at present engaged in bonding the Providence & Pawtucket line of the Union Railway Company, and states that other large contracts are in hand for cast-welded joints for both the Union Railway, of Providence, and the West End Company, of Boston.

JENKINS BROS., 71 John Street, New York, are manufacturing a very useful device known as the "Diamond" trap, for taking care of condensation and entrained water in steam-heating systems. The trap is designed for any steam-heating system using ¾ or 1 inch pipe. One of these will take care of 500 to 1000 feet of 1-inch pipe, and is entirely automatic in its operation. The traps are made in brass for general use and iron for water containing sulphur.

THE HOPPES MANUFACTURING COMPANY, of Springfield, O., reports a gratifying business for the past 60 days in its well-known feed-water purifiers and heaters. Among numerous other orders taken are the following: Columbus (O.) Railway Company, a 1300-hp heater; E. C. Atkins & Co., Indianapolis, Ind., a 625-hp purifier, and an 800-hp heater; the Rochester (N. Y.) Railway Company, a 2250-hp heater, and the Edison Electric Light & Power Company, Erie, Pa., a 500-hp heater.

G. F. EVANS, proprietor of the Evans Friction Cone Company, 85 Water Street, Boston, reports an increasing demand for the Evans friction cone pulleys, which is the natural result of investigation by power users of the merits of these appliances. The list of installations covers some of the largest manufacturing establishments in the country. Forty-seven different sizes of pulleys are manufactured, transmitting from 1 to 40 horse-power, and adapted to change the speed of all kinds of machinery while running.

THE BALL ENGINE COMPANY, of Erie, Pa., reports every department of its extensive establishment crowded with work; so much so that the shops have been running nights since last June. The erecting floors are covered with many engines in various stages of construction, among them especially noticeable being the large number of engines arranged for direct connection to generators, and it is stated that a large proportion of the engines built by this company at the present time are of that style. It is a significant fact that for the past four years every engine turned out of the Ball Company's works was used for electric power transmission in some form or other. Among the engines now in process of construction are a 300-hp vertical compound on the Los Angeles (Cal.) Street Railway, and a number of engines for the Troy Iron & Steel Company, Troy, N. Y.; Mabley Building, Detroit, Mich., and other parties in various parts of the country. The company states that there are sufficient orders in hand to keep the works busy for several months to come, and reports an unusual number of inquiries for this time of the year.

THE ROBINSON ELECTRIC TRUCK & SUPPLY COMPANY, 620 Atlantic Avenue, Boston, has received a commendation from Mr. John Scullin, president of the Union Depot Railway Company, St. Louis, who, after several years' extensive use of the truck, says that he regards the Robinson radial drill truck as "the best truck in the world," and the same, substantially, is the united verdict of the users of the truck in general. The construction and operation of this truck is well understood by most railway men, but to those unfamiliar with it, it may be briefly said to consist essentially of three flexibly connected, single, steel axle frames, each containing one pair of wheels. The end frames are pivotally connected to the car body, while the intermediate frame travels transversely across the car body, thereby causing the axles to become radial on curves and parallel on straight lines. The axles being radial, and therefore always at right angles to the line of travel, on curves as well as on straight tracks, the wheels revolve freely without binding, grinding or skidding, and with minimum wear of flanges and rails. The long wheel-base of the "Radial Car" (12 to 15 feet) supports the car body near the ends, so that there can be no rocking or "teetering," and therefore no racking and straining of the car body. Comfort to passengers and economy in operation are characteristics of this truck.

PLASTIC RAIL BONDS.—The Cleveland Electric Railway Company recently inspected and tightened the copper rail bonds on the Cedar Avenue line, where there were two sets of bonds; one of No. 0000 around the chair to the web of rail, and another of four No. 0 wires in a casting riveted to the tram near end of rail. After the tightening it is stated that the loss at each joint during heavy load ran from 0.08 to 0.35 volts per joint. The Brown plastic rail bond was then applied by drilling a horizontal hole through web of rail and sides of chair against same on each side of joint. The steel was amalgamated by the Edison process and the hole partly filled with plastic alloy, which thus made contact between rails and both chairs supporting same. Then a tapering soft iron plug was driven in from each side and held in place by a stove bolt through central hole in plugs. We are informed that after completing this work the drop was but 0.015 volts per joint at time of heaviest load. Another very promising field for the use of the plastic bond material has been developed by the Buffalo Railway Company; namely, the application of the plastic bond material to all unsoldered connections on dynamos, switches, bus-bars and instruments in the power-house, all unsoldered contacts on motor cars, and all line switches and cut-outs. It is claimed by Mr. Harold P. Brown, manufacturer of the plastic rail bond, that an application of the material to the unsoldered contacts in one large generator circuit has resulted in the saving of three electrical horse-power.

Record of Electric Railway Patents.

UNITED STATES PATENTS ISSUED DEC. 17, 1895.

551,362. COMPOUND RAILWAY RAIL; Willis W. Charles, Evansville, Ind., and Richard W. King, Wichita, Kan. Filed April 10, 1895. A railway rail comprising a base with two upwardly extending webs, one of which is shorter than the other, a crown having a downwardly extending web, fitting between the two webs from the base, and also a downwardly extending flange along the edge of such crown on the same side of the rail as the shorter web from the base, and an electrical conduit resting upon such shorter web, and held in place by the downwardly extending flange along the edge of the crown and provided with a side slot.

551,380. STREET-CAR FENDER; William J. Hinphy, Montreal, Canada, assignor of one-half to Hubert Root Ives, same place. Filed Sept. 21, 1894. In a car fender, a combination with a stationary main framing and means for attaching it to the car, of a movable inclined section pivotally connected to the forward end of the main framing, a flexible receiver extending between the rear of said framing and said movable inclined section, and having its side edges free and its ends only attached to such parts, and an auxiliary lifting device in the form of a pivoted frame located beneath such receiver, adapted to engage beneath said movable inclined section and actuated by pressure upon it to elevate such inclined section.

551,398. CAR SIGNAL; Elihu Nelson, New York, N. Y. Filed Dec. 21, 1893. A warning signal for street cars, consisting of sound-producing devices upon the car top, one or more horizontally reciprocating rods on the car top, and operatively connected with the sound-producing devices, devices moving with the car axle and adapted to operate the said reciprocating rod through suitable connections and means for adjusting the throw or length of movement of said rod.

551,418. HANDLE FOR BRAKE-STAFFS; William C. Van Dillen and John T. Van Dillen, St. Louis, Mo. Filed Sept. 11, 1895. A brake-staff handle comprising a handle portion proper, a socket formed at one end of the same for the reception of the brake-staff, a lateral extension or chamber communicating with said socket, a pawl mounted in said chamber, a convex spring plate interposed between pawl and the side wall of the socket, the convex portion of the spring resting against the wall, a pivoted knob carried by the free end of the handle, a lug depending from the knob in proximity to the pivotal point of the latter, a connecting-rod pivotally secured at one end to the lug, and being substantially parallel to the general axis of the handle, and having an inner extension substantially parallel to the movement of the pawl and connected to the latter and passing through suitable openings formed in the convex portion of the spring plate and in the wall on which said convex portion rests. (See Illustration.)

551,470. CONTROLLING ELECTRIC MOTORS; David Mason, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed April 22, 1892. The combination of two or more electric motors, one of which as a starter is provided with one or more sets of independent field coils; a brush for each terminal of the circuits of said coils, the armature of said motors and the field or fields of the other motor or motors; and a switching device provided with contact plates thereon, co-operating with said brushes, and which, when moved with respect to said brushes, serve first to connect the coils in series with each other, with the starter armature and with the other motor or motors; then to short-circuit one of said coils; then to connect said coils in multiple with each other, but in series with the starter armature and with the other motor or motors, and finally to connect said coils and the starter armature in multiple with the other motor or motors.

551,472. TRACTION MECHANISM FOR SELF-PROPELLING VEHICLE; Charles W. Parks, Troy, N. Y. Filed May 14, 1891. The combination with a car or locomotive truck provided with wheels to support its weight, hollow segmental guides secured to said truck, arms having one end adjustably retained in said guides, driving wheels and worm wheels carried at the opposite end of said arms, and worms in engagement with said worm wheels.

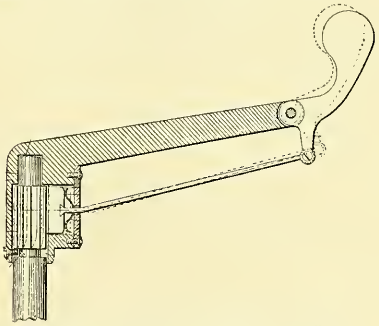
551,521. CAR FENDER; George H. Zane, Philadelphia, Pa. Filed May 31, 1895. In a car fender, swinging brake shoes adapted to contact with the wheels of the car, auxiliary brake shoes pivotally connected by levers with a trunk of the car and adapted to contact with the rails and said first-mentioned brake shoe, levers pivoted to the body of said car, links connecting said auxiliary brake levers and the last-mentioned levers, and a crossbar in front of and connecting said auxiliary brakes, said crossbar serving as a fender and thereby preventing any object from getting under the wheels. (See Illustration.)

551,534. CLOSED CONDUIT ELECTRIC RAILWAY SYSTEM; Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond

Electric Traction Company, of West Virginia. Filed Apr. 12, 1895. The combination of an insulated supply conductor, working conductor sections, magnets whose coils connect the sections in pairs, and collectors on the car forming a division of the motor current for actuating the pick-up switches between paths of substantially equal resistance, one of which, starting from a given switch, passes from one of a pair of sections, through the magnet of an advance section, while the second path passes through the magnet of the first-named section, whereby the magnets of successive sections are in multiple at the time the switch of an advance section is thrown.

551,535. CLOSED-CONDUIT RAILWAY SYSTEM; Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction Company, of West Virginia. Filed April 12, 1895. The combination of supply conductors, sectional working conductors between each branch of the motor circuit and the corresponding supply conductor, the sections being normally insulated from the corresponding supply conductors, switches for coupling the working sections to the respective supply conductors, and collectors on the car connected to opposite terminals of the motor, and bridging from one set of positive and negative sections to a similar set of sections, for establishing the circuit, shunting the motor for throwing an advance set of working sections into circuit with the respective supply conductors.

551,536. CLOSED-CONDUIT ELECTRIC RAILWAY SYSTEM; Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction Company, of West Virginia. Filed April 26, 1895. The combination in an electric railway of a supply conductor, a series of working sections or points arranged longitudinally one after the other in the direction of the line of travel, and divided into sets, each of which comprises three successive sections, switches adapted to connect the different sets of working conductors to the supply conductor, magnets for actuating the switches having a coil connected between two at least of the sections of each set when the switches are open, and collectors on the car arranged to form a circuit from a live section of one such set through the magnet of an advance set of sections for closing the corresponding advance switch.



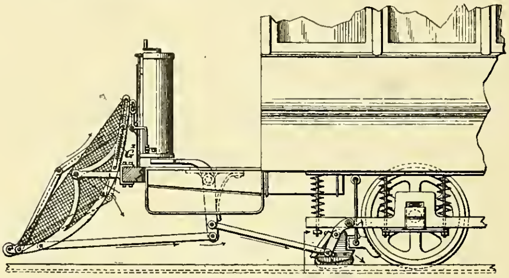
No. 531,418.—HANDLE FOR BRAKE STAFFS.

551,537. CLOSED-CONDUIT SYSTEM FOR ELECTRIC RAILWAYS; Frederick C. Esmond, Brooklyn, N. Y., assignor to the Esmond Electric Traction Company, of West Virginia. Filed Sept. 11, 1895. The combination of an insulated supply conductor, a series of working conductor sections normally disconnected from the supply conductor, switches for connecting the working sections with the supply conductor, and electromagnets for operating the switches, whose coils are connected at an intermediate point, and collectors on the car so arranged as to establish successively a circuit in series with the motor through the magnets for actuating an advance switch, and for including only a portion of the coils in the line circuit for holding the switches closed when they have been once thrown.

551,585. CAR FENDER; John Grant, Omaha, Neb. Filed Sept. 19, 1895. In a fender for cars, the combination of the following instrumentalities: a pivoted, spring-actuated apron working in a horizontal plane, a pivoted, spring-actuated dog, adapted to engage one end of said apron, side fenders working in a vertical plane, interlocking sectors secured to said side fenders, spring-actuated locking bars working within the sectors of said fenders, a spring-actuated pivoted lever secured to said locking bars, a lever connecting said pivoted lever to said spring-actuated dog, a tripping lever adapted to lock said pivoted lever in position under tension and a trigger extending from said side fenders to said tripping lever.

551,587. ELECTRIC RAILWAY; Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Company of America, same place. Filed Feb. 23, 1887. The combination of the wheels and axles, a truck frame supported upon the axles, an electric motor having rotating field magnets and armature supported directly by the axle within the frame and independent of said frame, and in which one of the rotating parts is secured to the said axle, a rotating commutator carried by the armature, traveling brushes carried by the field magnets, and means to change the lead of the brushes to reverse the motor.

551,621. STREET-RAILWAY CAR; Willard R. Dodson, Jermyn, Pa. Filed Aug. 7, 1895. In a street-railway car, a frame, the same comprising two sets of vertical side columns, window guides, and two rigid sides movably held at the outer side of each set of columns, said sides being provided with inwardly projecting portions having window guides aligning, when the sides are in place, with the window guides on the columns.



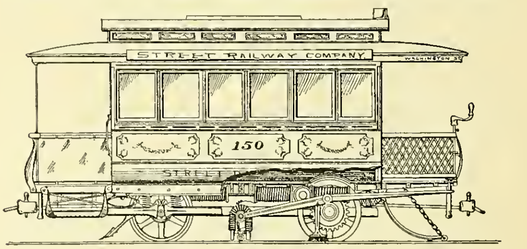
No 657,521.—CAR FENDER

551,664. ELECTRIC RAILWAY MOTOR SHIELD; Isaac F. Baker, and William R. McLain, Lynn, Mass., assignors to the Thomson-Houston Electric Company of Connecticut. Filed Nov. 25, 1889. The combination in an electric railway car, of a propelling electric motor supported beneath the car in close proximity to the ground, a shield interposed between the motor and the ground for the purpose of intercepting bits of magnetic material attracted from the ground, a pivoted or swinging hook sustaining the shield at one end, and a hinge at the other end of the shield whereby said shield may be swung down into position to permit access to the motor and running gear.

551,700. COMBINED CAR BRAKE AND FENDER; Joseph C. Walier, Syracuse, N. Y. Filed April 26, 1895. The combination, with a track brake, of track rollers secured to the front end of the brake and sustained with its tread above and in proximity to the plane of the track-bearing of the brake.

551,702. CAR FENDER; John A. Wolfram, Philadelphia, Pa., assignor of one half to Gottlieb J. Hutt, same place. Filed Aug. 2, 1895. In a car fender, a supporting frame, ratchet and pawl mechanism mounted thereon, a trigger adapted to actuate the same, grooved rollers and ways adjacent the same alongside of said trigger for causing the same to move uniformly, a frame below said fender, slotted bars or levers common thereto, and springs connected to said bars and to a suitable fixed point whereby the latter frame is caused to shoot forwardly when an object is struck.

551,734. TRANSMISSION OF ELECTRICITY TO MOVING CARS; Thomas Nesom, Indianapolis, Ind., assignor, by direct and mesne assignments of one half to William D. Eckenrode and Edward S. De Tamble, same place. Filed Sept. 21, 1894. In a system for transmitting electric power to a moving car, a lever mounted between its ends to the car axle, with one end extending beneath the car platform and the other to the middle of the car, means on the front end for the driver to actuate the lever, a magnet mounted on the inner end of the lever, a contact device mounted near the magnet, and a conductor leading from such contact device to the motor. (See Illustration.)



No. 551,734 —TRANSMISSION OF ELECTRICITY TO MOVING CARS

551,746. CAR AXLE; Samuel L. Denney, Atlantic City, N. J. Filed June 29, 1895. As an improvement in car axles, an axle divided near its mid-length, and each end of the adjoining parts enlarged to form the frustum of a cone, and having annular flanges at the meeting bases, in combination with a coupling sleeve formed with an interior to fit one end of the cone of one part of the axle, an adjustable sleeve on the other conical part of the axle, and fastening means to hold and adjust the coupling in position.

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